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Total Quality Management: Implications for Nursing Information Systems

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Total Quality Management:
Implications for Nursing Information Systems

Seminar Paper

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Abstract

Total quality management (TQM) is a management philosophy gaining widespread use in American production and service organizations. Though founded by Americans, it was popularized by its successful use in post war Japan. Top-level management commitment to quality, collaborative work efforts, process improvement, long-term commitment, measurement and statistical process control, investment in knowledge, and a customer focus are the core concepts. The Nursing Information Systems Specialist (NISS) who is well trained in TQM and implements a sound plan for its implementation, can aid in development of high quality information systems and support the quality improvement endeavors of the parent organization.

CHAPTER 1

The Problem

Background Information

Overview of TQM

The Department of Defense mandates it (Hunt, 1992). The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) based their new evaluation programs on it (Koska, 1991). Motorola and Ford Motor company turned losses into profits when they implemented it (Berwick, Godfrey, & Roessner, 1991). The Japanese have been using it's techniques successfully for years (Berwick et al., 1991; Hunt, 1992; Walton, 1986). "It" goes by many names -- quality control, quality improvement, continuous quality improvement (CQI), total quality management (TQM), quality first, total quality improvement (TQI), total quality leadership (TQL), etc. -- but the key concepts are similar (Eskildson & Yates, 1991; Holzemer, 1990; Oberle, 1990). Those key concepts of quality in production and service organizations include:

1. The need to look at the organization as one

interdependent system.

2. Adopting a new corporate culture and paradigm putting quality first.

3. Top level leadership and commitment in implementing quality management.

4. Constancy of purpose.

5. Customer focus, both internal and external.

6. Benchmarking.

7. A process orientation.

8. Continuous process improvement, with emphasis on prevention and improvement rather than on inspection.

9. Investment in knowledge.

10. Collaborative approach to process improvement.

11. Long-term commitment, rather than emphasis on short-term gains.

12. Quality measurement and statistical reports at all levels.

13. Total involvement (Arikian, 1991; Hume, 1990; Hunt, 1992; Kaegi, 1990; Sahney & Warden, 1990).

Other key concepts frequently mentioned include the need for sound customer-supplier relationships,

understanding the variability of processes as a key to improving quality, and that poor quality is costly (Berwick et al., 1991).

Actual definitions of this quality management approach differ along with the numerous "gurus" who have written extensively on the subject -- Deming, Juran, Crosby, Feigenbaum, Ishikawa, etc. (see Chapter 2). One of the most concise definitions on TQM was given in a speech by Blaine E. Hurst (1991) who said TQM is "A prevention based management system for identifying and meeting customer requirements at every level of every operation through continuous improvement in the processes through which products and services are produced." Other definitions reflect similar concepts, though the words may be different (Hume, 1990).

The recognized pioneer in the field is W. Edwards Deming who first found avid listeners for his message in Japan in 1950. It took another 30 years before American companies adopted quality improvement techniques, and has taken even longer for the health care industry to embrace and apply quality management

principles (Berwick et al., 1991; Dobyns, 1990; Hunt, 1992; Oberle, 1990; Sahney & Warden, 1990). Deming speaks of the 14 points of quality and the seven deadly diseases, which will be discussed in detail in Chapter 2, along with principles from the other recognized "quality gurus."

What exactly is "quality" in production and services -- the end goal of all TQM plans? It's been described as a "fitness for use" or "conformance to requirements," (Crawford-Mason, & Dobyns, 1991) but can basically be thought of as meeting the process and outcome demands of customers with reliability, responsiveness, assurance, empathy, and needed tangibles (Berry, Parasuraman, & Zeithaml, 1990; Berry, Parasuraman, & Zeithaml, 1991). The JCAHO further delineates quality in healthcare as how services assist in meeting desired patient outcomes while reducing the chance of unwanted consequences (West, 1990)

Relationship of TQM to Nursing Information Systems

The study of TQM guidelines and practices is vital to Nurse Information Systems Specialists (NISS) because of the questionable quality of current nursing

information systems, and the need for these systems to better support patient care quality and patient care quality improvement efforts. (Berg, 1983; Simpson, 1991; Simpson, 1992; West, 1990). In addition, TQM principles can help the NISS to manage and improve systems to better meet customer requirements -- whether internal (nursing and other hospital staff) or external (patients, JCAHO, government agencies, vendors, etc.) customers.

Problem Statement

The problem derives from this relationship between TQM and nursing information systems. There is a need for the NISS to study TQM principles and implement TQM plans and techniques to improve the quality of nursing information systems to better meet customer needs and support quality improvement efforts.

Supportive Evidence

Evidence to support the need for utilizing TQM practices in managing nursing information systems is implied throughout the literature. Studies show that 85% of all quality problems in production and service occur due to poor process management and that there are

many costs of poor quality -- most of which are hidden (Hurst, 1991; Milakovich, 1991; President and Fellows of Harvard College, 1987). Obvious costs can include customer complaints, errors, excessive overtime, unnecessary rework, and quality assurance department expenses. Hidden costs can include staff frustration, lack of teamwork, malfunctioning or outdated equipment, lack of competitive knowledge, inaccurate or missing information, bad reputation, dissatisfied patients, etc (Milakovich, 1991). While few studies have been published, I believe this same list could be applied to many of the nursing information systems in use. Industry has shown that taking a TQM approach to quality prevents problems, improves processes, and decreases the costs of poor quality (Albert, 1989; Berwick, 1989; Milakovich, 1991).

Unfortunately, it is rare to see a TQM approach in health care and health care industry, where the "customers" and "suppliers" of care and services function as partners (Berwick, 1989; Lehr & Strosberg, 1991). But that tendency is changing as the JCAHO and others recognize the need for implementing CQI

practices throughout the healthcare industry (Albert, 1989; Arikian, 1991; Berwick, 1989; Berwick, 1991; Berwick et al., 1991; Darr, 1990; Deming, 1987; Hoesing & Kirk, 1990; Jeffer, 1991; Kaegi, 1990; Koska, 1991; Matthews, 1992; O'Leary, 1991; Ruark-Hearst, 1990; Sahney & Warden, 1990). Forces pushing for TQM/CQI implementation in health care include the rising cost of health care in America, the wide-spread belief that the increased costs have not resulted in increased quality of care, rising malpractice costs, increased government regulation, and the need for a better way to measure quality of health care (Arikian, 1991; Berwick et al., 1991).

As noted above, authors have repeatedly questioned the quality of current nursing information systems. It stands to reason that the same practices that have transformed and improved products and services in companies and a handful of health care agencies, could also help improve the quality of nursing information systems. As part of its CQI emphasis, the JCAHO has called for increased involvement of nursing management in identifying hospital and nursing information system

needs, in making procurement decisions, and in evaluating results of the decisions (Joint Commission on Accreditation of Healthcare Organizations, 1991; Patterson, 1991; Simpson, 1991). The JCAHO and others have also identified the tremendous impact improved hospital and nursing information systems can have in assisting an agency to gather and present the information needed to implement a good CQI/TQM program (Hurley, 1991; Koska, 1990; Patterson, 1990; Shanahan, 1988). This evidence further supports the need for the NISS to study and utilize TQM techniques.

Approach

To assist the NISS in understanding TQM principles and techniques, a thorough review of the literature is presented in Chapter 2 of this paper. This review further defines TQM/CQI and its key concepts, and differentiates CQI from older Quality Assurance practices. Major tools used in TQM are explained. In addition, the history of the quality movement is introduced, along with the contributions of key quality authors, including Deming, Juran, Crosby, Costello, and Ishikawa. The use of TQM in business and in healthcare

is then presented, with the emerging evidence of its use in healthcare information systems. Finally, views on both the pros and cons of TQM are addressed.

Chapter 3 applies the concepts learned by showing the potential for implementing TQM in the systems life cycle. TQM's possible use to improve the quality of nursing information systems, improve the management of NIS departments and agencies, and the NIS role in facilitating TQM implementation in an agency is discussed.

Chapter 4 summarizes the paper presenting the conclusion, implications, and recommendations this study suggested.

Objective

The universal objective of this paper is to present a primer on TQM for potential use to improve nursing information systems, systems management, and use of information systems to support the TQM/CQI plans of healthcare agencies.

CHAPTER 2

Review of the Literature

What is TQM?

A composite definition of TQM was presented in Chapter 1, along with a list of concepts most frequently used to describe principles and techniques of quality management. Different quality authors stress the precepts they see as having the most relevance in instituting a quality program. This author feels the particular organization, organizational maturity, and situation may dictate which approaches are best suited for a successful TQM plan. However, a thorough understanding of the most frequently used TQM terms enables the quality implementer to better plan for total improvement. These terms are presented in detail below.

Key Concepts

Interdependence of system. To effectively look for areas of organizational improvement, the quality implementer must realize that the organization is one interdependent system made up of work units, suppliers, and customers (internal and external) (Hunt, 1992).

All must interact in a healthy way to create a quality product or service. Rather than just focusing on the end product to determine quality, emphasis on the processes, components, and interactions that contribute to the outcome are vital. As one author wrote, "most service failures are not failures: they have been designed into the system" (Heskett & Schlesinger, 1991, p. 73). Understanding that system must be an early step to quality improvement.

Commitment of top level leadership. Most quality authors stress the importance of top level leadership and commitment to quality improvement. A top-down approach to initiating TQM helps provide the vision, corporate philosophy, and planning needed for a TQM program to be successful, along with stressing the responsibility and accountability managers must take in improving quality (Albert, 1989; Arikian, 1991; Berwick et al., 1991; Garvin, 1987; Geber, 1990; Green, & Katz, 1992; Hunt, 1992; Leonard, 1989; Merry, 1991). Top managers can show this commitment to QI by doing the following:

1. Seek to improve the system, rather than

allocating blame.

2. See themselves as suppliers to internal customers, whose needs and expectations they strive to understand and exceed.

3. Teach quality improvement to their workers.

4. Continually expand their quality improvement knowledge.

5. Ask for data from within, and outside, their organization.

6. Expand the use of QI throughout the organization, giving management guidance and assistance with planning.

7. Eliminate barriers to total involvement and commitment to quality.

8. Manage by walking around (MBA). True understanding of the system cannot be gained by sitting behind a desk.

9. Communicate -- including active listening.

10. Follow-up on suggestions.

11. Bridge the gap between the internal and external customers.

12. Actively take part in QI projects and teams.

13. Create a corporate culture and strategies that foster QI efforts (Hacquebord, & Scholtes, 1988; Merry, 1990; Sahney & Warden, 1990).

Emphasis on quality in corporate culture. As mentioned above, top management must create a corporate culture that emphasizes quality improvement efforts throughout the organization (Berwick et al., 1991; Hunt, 1992; Leonard, 1989). But it must be recognized that establishing such a cultural change is a long-term project, usually taking between three to ten years (Arikian, 1991; Sahney & Warden, 1990). Ways to show the significance of quality include:

1. Demonstrating executive commitment, and not assigning all responsibility for quality to others.

2. Not making assumptions about the needs and expectations of customers (internal and external), but listening to them instead.

3. Encouraging doing the right thing right, the first time.

4. Understanding the costs (overt and hidden) of poor quality.

5. Prevention, not inspection.

6. Look for continuous, long-term improvements, not the short-term, one-time fixes.

7. Fostering total involvement in quality efforts.

8. Making quality a well-defined corporate strategy.

9. Analytically understanding the present culture.

10. Placing quality before profits.

11. Employee empowerment.

12. Trust in the employee.

13. Decentralization of authority.

14. Making middle managers leaders instead of controllers.

15. Allocate necessary resources for TQM projects (Albert, 1989; Arikian, 1991; Garvin, 1987; Heskett & Schlesinger, 1991; Hume, 1990; Hunt, 1992; Hurst, 1991; Miller, 1991; Sahney & Warden, 1990).

Constancy of purpose. Providing constancy of purpose is another responsibility of top management. Giving the organization clear and consistent vision, goals, and objectives allows workers to plan their

actions accordingly (Hunt, 1992).

W. E. Deming also sees constancy of purpose as the actions management takes and encourages to show commitment to quality -- innovation, research and education, continuous improvement, and maintenance of equipment and facilities as well as new aids for workers to use to improve quality (Deming, 1986; Walton, 1886).

Focus on customer. Customer focus is a universal concept of quality discussed in the literature. The term "customer" refers to both internal customers -- those within the organization, as well as external customers -- which can include users as well as suppliers of products and services. An organization that doesn't take internal and external customer needs and expectations into consideration when producing a product or service, is doomed to poor quality (Albert, 1989; Berry et al., 1990; Berry et al., 1991; Berwick et al., 1991; Geber, 1990; Leonard, 1989). Indeed, most of the ideas for improving quality usually come from customers (Berwick et al., 1991).

It must be acknowledged that customers are the

reason for being for the organization, and that their involvement in process planning and improvement and their satisfaction with outcomes are essential (Clausing & Hauser, 1988; Headrick, Melnikow, Neuhauser, & Vanek, 1991). Management must also recognize that these expectations and needs are ever-changing, and must be continually reassessed (Hunt, 1992). After internal and external customers are identified, eliciting their needed input can be done via questionnaires, surveys, interviews, customer focus groups, feedback from competitors' customers, service audits (selectively auditing customer interfaces with the organization), listening to employees, feedback to customers' recommendations, brainstorming and responsive suggestion programs, (Albrecht, 1990; Berwick et al., 1991; Hume, 1990; Sahney & Warden, 1990). Characteristics of customer interaction that impact on quality include the complexity of the interaction, the number of people involved, the number of handoffs between departments, friendliness of direct-contact people, speed in getting things done, quality of information provided to the customer,

features, durability, aesthetics, reliability, flexibility in responding to requests, and the demands put on the customer (Albrecht, 1990; Garvin, 1987). Unfortunately, too many organizations do not understand the importance of friendly, competent quality workers at the points of interaction with internal and external customers (Heskett & Schlesinger, 1991). Nor do they understand the importance of on-going partnerships with suppliers, which can foster mutually beneficial quality outcomes (Arikian, 1991).

Benchmarking of process and outcomes. Benchmarking is another key concept of TQM pervasive in the literature. It is defined as a continuous process of measuring or comparing an organization's products, services, methods, processes, and practices against the toughest competitors or those known to be leaders in particular fields or techniques (Air Force Logistics Command, 1991; Hunt, 1992; Sahney & Warden, 1990). Benchmarking can be made against other units of the same organization (Camp, Tucker, & Zivan, 1987). The ultimate goal is to gain a competitive edge by closing gaps in quality with competitors and learning ways to

exceed their quality.

Finding your competitors or internal work units who excel in practices is usually fairly easy. They're the ones talked about most within your organization's field. However, finding targets for benchmarking among non-competitors is more difficult, though often most useful (Camp et al., 1987). Lack of knowledge of their specialty contributes to the difficulty. Trade journals, consultants, annual reports, conferences, and professional meetings are all potential identification aids (Camp et al., 1987). But while finding organizations to benchmark among non-competitors is laborious, it is usually easier to gain their cooperation than gaining competitors' assistance.

The process of benchmarking involves four major steps:

1. Figuring out what to benchmark.

2. Finding the object of benchmarking efforts.

3. Finding out how the organization achieves the results.

4. Deciding to implement the changes needed in your organization to meet or exceed the benchmark

(Hunt, 1992).

Focus on process improvement. Poorly planned and implemented processes, not individuals, account for more than 85% of all errors or delay problems (Coffey & Marszalek-Gaucher, 1991; Deming, 1982; Hume, 1990; Kaegi, 1990; Sahney & Warden, 1990). Most of these processes involve more than one department and are a result of management choices. As a result, quality experts stress the need to spotlight process improvements in organizations -- particularly where work units interact (Heskett & Schlesinger, 1991; Hume, 1990). This changes the traditional way of "assuring" quality -- by centering attention on the finished product or service and inspection rather than prevention (Berwick et al., 1991; Geber, 1990; Hunt, 1992).

Microanalysis is often employed, as staff members continually examine work processes, defining problems or areas for improvement, and implementing small refinements at a time. Authors label the process improvement activities as PDCA -- plan, do, check, and act (Hume, 1990).

Planning involves defining measures of quality, measuring performance, analyzing the process, and identifying improvement actions by using statistical quality control. Doing is the actual implementation of improvement actions -- those that eliminate redundancies, rework, and waste. Checking is measuring the results of improvement efforts. Acting finally makes the improvement part of the norm by reflecting it in plans and procedures (Barth, 1989; Hume, 1990). Process improvement is continuous, and the PDCA cycle perpetually repeats.

Paramount in process improvement is the understanding of common and special cause variation. Common causes variation in processes (also called random causes), permeate the process and are the focus of most process improvement activities. Special cause variation are usually the result of some intervening event or breakdown (Hume, 1990). If important causes in variation are not identified and controlled, quality will suffer (Berwick et al., 1991).

Investment in knowledge. Educating workers throughout the organization is a necessary quality

investment, according to TQM theory (Arikian, 1991; Leonard, 1989; Sahney & Warden, 1990). They require continuous training both in quality improvement techniques as well as opportunities to improve job knowledge and skills. Besides specific training required for collaborative activities, described below, employee education may be technical and related to job skills, systems orientation training, new technical skills, a basic overview of quality, quality technical advisor training, and quality leadership training (Hacquebord & Scholtes, 1988). Some believe any on-going training will ultimately benefit the organization (Dobyns, 1990; Heskett & Schlesinger, 1991; Walton, 1986). Investment in staff instruction helps assure a motivated, talented work force equipped with up to date information needed to maximize TQM efforts and deal with new work methods -- perhaps even new assignments within the organization (Heskett & Schlesinger, 1991; Hunt, 1992; Walton, 1986).

Emphasis on teamwork/collaboration. Teamwork (sometimes referred to as collaboration) is another essential feature of TQM activities. It complements

the next concept, total involvement, with an aim of fostering universal efforts in the TQM organization (Hunt, 1992). Equally important benefits of collaboration are an expanded knowledge base of quality improvement workers, and shared goals among workers, customers, functions, and/or departments, and improved communication and cooperation between departments or management and workers (Milakovich, 1991; Sahney & Warden, 1990). In addition, by bringing together staff from a cross-section of the organization (horizontally and/or vertically), those processes needing improvement that traverse work boundaries are best addressed (Arikian, 1991; Berry et al., 1990; Berwick et al., 1991; Hunt, 1992; Walton, 1986).

Management could form their own quality council that tackles an issue and charges another team among line workers to do the same. Or management can sit directly on teams with workers, which can assist in the upward flow of information and speed decision making (Berwick et al., 1991). Team membership between six to ten (some even say up to twelve, fifteen or twenty) can ease communication, yet still benefit from differing

views and knowledge bases (Albert, 1989; Berry et al., 1990; Milakovich, 1991; Sahney & Warden, 1990). Regular meetings, adequate time for meetings, and leadership support can all add to success (Berwick et al., 1991).

Unlike teams often thrown haphazardly together in some organizations (including academia), management must insure quality teams are first trained in quality improvement techniques. Training must include use of statistical tools (discussed below) and structured problem-solving (Miller, 1991). Other potential educational areas are team leadership training, communication, nominal group method, multivoting, brainstorming, conflict resolution, the PDCA cycle, quality circles, and meeting planning (Milakovich, 1991).

Once trained, the group examines an improvement activity appropriate for its area of responsibility (Hunt, 1992). Such activities could include functional requirements definition, performance measurement and assessment, policy setting, decisions on new directions, a particular process improvement endeavor,

or customer recognition (Hunt, 1992; Walton, 1986). Individual team members may communicate, help identify improvement opportunities, gather data, problem or opportunity select, analyze causes, recommend solutions, and analyze solutions (Leonard, 1989). TQM statistical tools are a form of standardizing information presentation so all members can understand group efforts (Hunt, 1992). Working together on such ventures increases the base of ownership for the project, helping to secure success (Berwick et al., 1991; Walton, 1986).

Involvement of everyone. Along with the concept of teamwork, is the requirement that the entire organization (from the chief executive down)becomes personally involved in quality improvement. This is important because of the wide-spread interaction of departments and people that affect processes needing improvement (Berwick et al., 1991). Total involvement calls for participation of all, as well as empowerment of all employees to authorize them to make quality decisions and take needed actions (Geber, 1990; Heskett & Schlesinger, 1991; Hume, 1990; Hunt, 1992; Merry,

1990; Milakovich, 1991). Managements's own quality commitment, trust in the worth of their staff, clear objectives, and open communication fosters universal TQM efforts (Hunt, 1992).

Recognition and reward. Though an often mentioned concept of quality, authors conflict on how to reward quality endeavors. W. E. Deming is adamant about not setting performance targets (Walton, 1986), yet others stress the need to recognize and reward for exceeding targets via quality efforts (Heskett & Schlesinger, 1991). There is general agreement, however, that staff should never be punished for their quality work and that quality means an investment in workers -- including not firing at the first sign of economic loss (Hunt, 1992; Walton, 1986).

Deming states that performance evaluations, as most are written, breed fear; encourage short-term performance rather than long-term planning; discourage risk-taking; and undermine teamwork by fostering individual competition (Walton, 1986). Individual performance is rated, yet how can one take into consideration work done as a team? And when team

members compete for evaluation ratings and promotions, teamwork can suffer. An effective evaluation and reward system must do away with such obstacles to promoting TQM activities (Geber, 1990).

Authors such as Berry et al. (1990) and Miller (1991) see measuring employee performance against standards as motivating and a useful management tool. They also recommend observations and customer feedback as valuable ways to rate and reward staff. Recognition and reward for exceeding standards can include compensation or financial incentives. Team awards are also encouraged, though Deming might argue this still fosters competition in the organization. Others suggest a Quality Day in the organization where teams present projects, with top management present (Sahney & Warden, 1990).

In this author's view, some award and recognition is probably necessary to motivate and encourage quality efforts and innovation, though most award and recognition systems need their own quality improvement initiatives.

Commitment for long-term. The need to make a

long-term commitment to quality improvement is another cornerstone of TQM -- it is not a one-time effort. Implementing a TQM plan can take from three to ten years (Hunt, 1992). But the commitment must be long-term for a variety of reasons, including the need to plan for long-term benefits in the face of immediate pressures, restructuring the corporate climate to support quality throughout the organization, the need to eventually get everyone trained and involved in quality endeavors, and the recognition that there must be on-going continuous efforts to improve (Hunt, 1992; Miller, 1991; Walton, 1986). Research has shown that despite the time it takes to have TQM permeate an organization, return on investment is almost immediate, with many reporting efforts paying for themselves within the first year of implementation (Hunt, 1992).

Success of this long-term dedication can be seen once top management spends more time and effort on quality improvement than on solving financial problems or "putting out fires"; when quality issues are discussed at all organizational meetings, and when everyone applies TQM techniques regularly (Sahney &

Warden, 1990; Walton, 1986). Then it can be said that the organization has transformed, yet TQM practices must be perpetuated (Sahney & Warden ,1990).

Cost of poor quality. The need for a long-term and continuous commitment to TQM is the basic fact that poor quality increases costs to both the organization and its customers (Berwick et al., 1991). If processes are poorly designed, they will not meet customer expectations and needs. Costs are incurred via waste, rework, loss of market share, and possibly liability suits (Berwick et al., 1991). It is estimated that between 25 to 30 percent -- some even claim 50 percent -- of total costs of products and services are due to process failures (Berwick et al., 1991; Hunt, 1992). This holds true for the healthcare industry as well as other production and services industries (Milakovich, 1991).

The cost of quality is measured by understanding both the hidden (or indirect) and visible (or direct) costs. Hidden costs can include a bad reputation with customers, a frustrated staff, or missing charts in a hospital. Visible costs can include customer

complaints, staff overtime, or lost lab results (Milakovich, 1991). Visible costs can be subdivided into those of conformance (prevention and appraisal) and those of nonconformance (internal and external failures) (Hunt, 1992; Milakovich, 1991). The conformance costs are measured by comparing work output against customer requirements. Nonconformance costs are those costs incurred by not meeting, or even by exceeding (with something not valued by the customer), customer requirements, and can be measured in the time needed to do rework. In addition, there are lost opportunity costs -- profits not earned due to losing customers (Hunt, 1992). Studies show that a well implemented TQM plan can greatly reduce the failure and appraisal costs (Hunt, 1992).

Organizations often assert they do not have the time or money to implement TQM. However, not only is quality free, but it must be thought of as a profit maker (Hunt, 1992). An organization cannot afford <u>not</u> to implement quality improvement.

<u>Emphasis on measurement and statistics</u>. Finally, measurement and statistics are an integral part of any

successful TQM program. All employees must become familiar and comfortable with their use in understanding and improving processes.

Statistics and measurement help recognize special and common causes of variation (see Focus on process improvement above). Special causes are easier to identify. Once they are brought under control, it will be easier to understand the common causes on which to focus improvement efforts (Walton, 1986). These same measurements can then measure the results of the improvement attempts (Geber, 1991). Decisions in the improvement process are therefore based on fact, rather than opinion (Hume, 1990). In short, they assist one to organize, analyze, visualize, and understand quality information (Hunt, 1992).

The math abilities needed to learn TQM statistics is at a seventh or eighth grade level and fairly easy to use after training (Hume, 1990; Walton, 1986). They should not inhibit the total involvement needed for TQM plans. The basic tools for process improvement -- cause and effect diagram, bar chart, checksheet, flow chart, Pareto chart, run chart, histogram, control chart, and

scattergram -- are discussed in the next section (Barth, 1989; Walton, 1986).

Key Tools

The most important tool in implementing a TQM program is a solid plan to incorporate all of the above concepts of quality management into the organization. In this section, the key statistical and measurement tools needed for process improvement are discussed. Readers are referred to Guide to Quality Control (Ishikawa, 1976) or The Deming Management Method (Walton, 1986) for more in-depth information. The decision on which tool to use is based on the purpose of the study and the experience and partiality of the users (Hunt, 1992).

Cause-and-effect diagram. This tool is also known as the fishbone or the Ishikawa (its inventor) diagram. It helps show the characteristics of a problem or process and the factors or causes that contribute to them (Barth, 1989; Hume, 1990; Hunt, 1992). It is most useful during brainstorming, to help understand a process, or in planning improvement activities. The problem or effect is placed to the right (head of the

fish) while to the left are the causes (or bones), arranged by categories (see Appendix A).

The steps to construct this diagram are:

1. Define the effect (problem) as best possible and place it to right.

2. Brainstorm causes (the whys).

3. Categorize causes, and place their labels as "big bones."

4. Place causes as "small bones."

5. Continue asking for "whys" and add.

6. Highlight most likely causes.

7. Use other tools to verify causes (Hunt, 1992).

The benefits of this tool include the ability to:

1. Stimulate thinking about the process.

2. Focus discussion.

3. Lead to verifying actual causes.

4. Be used for any problem (Walton, 1986).

Checksheet. A checksheet (see Appendix B) is a simple count of frequency of number of times particular events happen (Barth, 1989; Hume, 1990; Hunt, 1992). The user is not interested in "why" but in what, who, where, when, or how. A grid is made of the categories

of information and the count of occurrences. Brainstorming and/or multivoting can determine what to count (Hunt, 1992).

Bar chart. Bar charts allow comparisons of quantities of variables measured (Hunt, 1992). The height of the columns (or bars) (or length of the rows for horizontal bar charts) show the relative frequency of the occurrence (see Appendix C). The steps involved include:

1. Collect raw data (possibly using a checksheet).

2. List and label the categories (nominal data) across the horizontal scale.

3. Write the vertical scale insuring the largest and smallest values can be included.

4. Draw bars to represent the quantities of each category measured, insuring the bars do not touch.

5. Multiple bars can be draw for each category, possibly showing measurements at different time periods.

6. Title the chart and include legends (Hunt, 1992). Advantages include its wide potential and ease

of use.

Flow chart. Flow charts are used to understand steps involved in a process, via a pictorial representation, so subsequent measures can be taken to improve the process (Hume, 1990; Hunt, 1992; Walton, 1986). Relationships become clearer, as often steps in a process aren't readily known until a flow chart is developed (Walton, 1986).

Three types of flow charts are commonly used in TQM -- the top-down flow chart, detailed flow chart, and the work-flow diagram (Hunt, 1992). The first variety outlines the most important steps in a process and is fairly easy to construct and understand. This type can also form the basis for the more detailed flow chart, which shows all process steps, decision points, and feedback loops. This detailed chart is usually only used if the other types do not show sufficient technicalities (Hunt, 1992). Finally, the work-flow diagram gives a picture of how work flows through the organization (Hunt, 1992) (see Appendix D).

Pareto chart. The Pareto chart assists the user to isolate the importance of certain data (problems or

causes) compared to other. As often explained, it helps to sort out the "vital few" from the "trivial many" (Hume, 1990; Hunt, 1992; Walton, 1986). The Pareto principle (named after an Italian economist) identified by quality expert Joseph Juran, states that only a few variables (20 percent) explain the bulk (80 percent) of the problems (Hunt, 1992). Therefore the diagram can show which problems to tackle and in what order (Barth, 1989).

The Pareto looks very much like a bar chart, except that the bars are lined up in descending order of importance (according to frequency, cost, time, or another important criterium). The steps of creating a Pareto chart include:

1. Select the primary causes of a problem (usually from a cause-and-effect diagram).

2. Collect observation data on these causes (via a checksheet type tally).

3. Calculate the percentage of each cause.

4. Set the right vertical scale from 0-100 percent.

5. Set the left vertical scale, matching the top

to the total number of observations.

6. Draw the bars for each category of observation.

7. Plot the first point of the pie-like connecting line at the upper right corner of the first bar.

8. Add the percentages for causes one and two. Plot the result above bar two. Continue doing a cumulative addition of percentages and plotting results above the corresponding bars. The last point should equal 100 percent.

9. Join the dots with a line (Hunt, 1992; Larson, 1990) (see Appendix E).

Run chart. The run chart is also referred to as a time line chart in the literature. It allows a graphical display of the change in data results over time, to track trends (Barth, 1989; Hunt, 1992; Walton, 1986) (Appendix F). The horizontal scale is divided into some measure of time -- such as days of the week, months, years, etc.). The vertical scale represents the quantity of occurrences, either in frequency or percentage (Hunt, 1992). The chart is made by:

1. Collect the raw data.

2. Place evenly spaced time intervals along the horizontal axis.

3. Place evenly spaced intervals for the vertical axis.

4. Plot the quantities observed and connect via a line.

5. Add grid lines to clarify the results if needed.

6. Add title and legends to clarify (Hunt, 1992).

Histogram. The histogram is another means of graphically displaying how frequently something occurs (Hume, 1990; Walton, 1986). It shows the distribution of the variable data by using connecting bars proportional in height to the frequency of the group counted (Hunt, 1992). It is particularly useful in setting standards from which to compare future results against expected variation (Barth, 1989).

Prepare a histogram by:

1. Collect the data and count the total number of observations counted.

2. Determine the range of the results (largest

result minus smallest).

3. Divide the range by the number of desired data bars (from six to twelve).

4. Place class intervals along the horizontal axis.

5. Place vertical frequency scale.

6. Arrange data points in ascending order.

7. Draw the height of each bar to correspond with appropriate frequency (Hunt, 1992) (see Appendix G).

Scatter diagram. The scattergram (or scatter diagram) is a means to show the relationship between two variables -- such as between light levels and computer errors (Barth, 1989; Hume, 1990; Hunt, 1992; Walton, 1986). The distribution of the data points on the diagram show the strength of that correlation (Hunt, 1992). Even if strong, this does not prove causes. If there is such a correlation, however, the user expects the measure of one variable to change when the other variable changes. It can change positively (as one increases, the other increases), or the measures can change negatively (as one increases, the other decreases (Hunt, 1992). The steps involved in

constructing the diagram include:

1. Collect data on the two variables being measured.

2. Draw equal horizontal and vertical scales.

3. The dependent variable data points are plotted along the horizontal axis.

4. The independent data points are plotted along the vertical axis.

5. The results give a visual check of the correlation. However more indepth statistics (such as a Pearson r) can quantify the relationship (Hunt, 1992) (see Appendix H).

Control chart. The control chart is another tool for analyzing processes that is relatively easy to use (Walton, 1986). It is an aid in monitoring process performance that has recurrent outputs (Hunt, 1992). There are many types of control charts, the use of which is called Statistical Quality Control (SQC) or Statistical Process Control (SPC) (Walton, 1986). Some types are used when the data can be quantified. Others are for nominal level data (Walton, 1986). They are based on four principles:

1. Processes change with time.

2. Points are variable.

3. Groups of points tend to fall within a predictable range if the process is stable.

4. If the process is unstable, fluctuations are more often out of normal operating ranges (special causes of variation) (Hunt, 1992).

First an upper and lower control limit must be obtained by observing a process's outputs over a time period, and using a formula to set the expected limits, based on variability. Then:

1. Collect data.

2. Plot the data on the chart which outlines the upper and lower control limits.

3. Determine causes of the points outside the limits.

4. Determine ways to eliminate the special causes, decrease common cause variation, and improve the overall mean. Constant use of the chart can show results of the changes made in the process (Hunt, 1992). See Appendix I for an example of a control chart.

Differences Between Quality Assurance (QA) and TQM/CQI

Now that the key concepts and tools of TQM have been explained, it is important to summarize the differences between TQM and quality assurance. This is needed to emphasize the fact that QA, as currently practiced in most healthcare settings, does not "assure" quality -- and, indeed, often does not even measure quality in healthcare (Berwick et al., 1991).

The Joint Commission for Accreditation of Healthcare Organizations (JCAHO) defines quality in healthcare as "the degree to which patient care services increase the probability of desired outcomes and reduce the probability of undesired outcomes given the current state of knowledge " (Green & Katz, 1992). That organization, through their Agenda for Change, as well as other agencies, have examined the current QA processes in healthcare and called for changes in the way quality is managed and improved by encouraging the implementation of TQM /CQI practices (Green & Katz, 1992; Williams, 1991). Traditional QA calls for inspection-oriented detection of problems (Darr, 1991; Schmitt, 1991). This is most frequently done by

reviewing the patient chart as the source of data, and has a reactive, random approach. CQI calls for prevention via good process planning and a proactive approach to problem solving and quality improvement (Appel & Weaver, 1991; Berwick et al., 1991; Eskildson & Yates, 1991; Green & Katz, 1992; O'Leary, 1991). QA also focuses most efforts on correcting special causes of variation, while CQI takes correction further by controlling the common causes of variation, as well, and continually improving processes (Appel & Weaver, 1991; Sahney & Warden, 1990).

QA is also viewed in most organizations as the responsibility of a few, with problems solved by authority. In a CQI organization, quality is the responsibility of all, with problem-solving done by all employees, at any level in the chain of command (Appel & Weaver, 1991; Sahney & Warden, 1990). Leadership also takes a much more active role in quality improvement organizations.

Another major difference between the two approaches to quality is that QA focuses efforts on finding the poor performers in the organization by

taking the view that individuals cause problems, while CQI focuses on poorly planned processes (Berwick, 1989; Darr, 1991; Hunt, 1992; O'Leary, 1991; Sahney & Warden, 1990). Management often projects a negative view of employees, rather than recognizing the individual desire to do a good job (Merry, 1990). QA personnel also view tasks such as insuring staff are certified and licensed "assures" quality (Merry, 1991).

The QA approach also looks at quality and productivity as being conflicting goals, rather than recognizing that quality improvement brings productivity gains (Hunt, 1992). In conjunction with this thought, supplier relationships are usually short-term and cost-oriented in the QA organization, rather that long-term, quality-oriented in the TQM mold (Hunt, 1992).

Still another contrast between QA and CQI is that QA time is usually spent attempting to meet external, minimally set, requirements and regulations, rather than setting and improving upon the organization's own high quality expectations (while still taking external customers' needed into account) (Hunt, 1992; Merry,

1991; O'Leary, 1991; Sahney & Warden, 1990). In summary, current QA practices can be viewed more as an attempt to appease regulators, rather than to improve the patient experience in the healthcare system.

History of TQM

A brief history of TQM/CQI is presented to assist the reader to understand that quality improvement is not a new philosophy or fad that will be quickly abandoned once an organization makes the commitment to adopt its beliefs. Instead, its ideas and practice have been developing for over 60 years (Hunt, 1992). Its roots were in the 1930's when W. E. Deming and W. A. Shewhart (a statistician) worked together at Bell Telephone Laboratories and became convinced that old management methods were not promoting good quality products. They implemented statistical control techniques and Deming advocated other quality improvement practices. Some of these were used in war production plants in America during WWII, but after the conflict, few companies in America saw the need for such efforts, as productivity and consumer spending were high (Hunt, 1992).

Quality improvement wasn't widely adopted until Deming was sent to Japan in 1947 to assist with a post war national census. The Japanese were the ones who took his evolving philosophy of quality and put it into practice. There is even a Deming Award in Japan for demonstrated outstanding product quality (Hunt, 1992). It would not be until the 1980's that some recession-prone American businesses would rediscover quality improvement, and not until the 1990's that healthcare organizations would recognize its potential for quality in health (Berwick et al., 1991; Hunt, 1992).

Today there are many variations of the quality improvement philosophy presented by the well-know authors in the field. Below is a brief overview of some of these authors and their beliefs about quality. It is this author's view that picking and choosing from among these experts' recommendations can result in a CQI program best able to meet your organization's and customers' needs.

Key Contributors

Deming. As mentioned above, W. E. Deming is usually attributed as being the founder of continuous

quality management, and his views are cited most frequently among quality authors. He was born in 1900 and received a masters in mathematics and physics from the University of Colorado and a doctorate in physics from Yale (Hunt, 1992; Walton, 1986). Working in the summer at Western Electric's Hawthorne plant where the Hawthorne studies on human relations were done, he questioned traditional management techniques' ability to motivate workers and produce quality products (Hunt, 1992). But it was at the US Department of Agriculture and at Bell Laboratories that he began refining his quality management philosophy. Shewhart, whom he later worked with, was developing statistical control processes at Bell, establishing upper and lower limits of variability (see control chart above) and control techniques for workers. Deming studied with Shewart and used his theories of quality control as a basis of his work (March & Garvin, 1987; Oberle, 1990; Walton, 1986).

Deming's main philosophy consists of the seven deadly diseases of management and his fourteen points for solving them. The deadly diseases are:

1. Lack of constancy of purpose.

2. Emphasis on short-term profits.

3. Evaluation by performance, merit rating, or annual review of performance.

4. Mobility of management (therefore lack of long-term commitment).

5. Use of visible figures alone. (He believes this does not take customers' happiness into account).

6. Excessive medical costs for employee health care.

7. Excessive costs of warranty, fueled by litigation (Hunt, 1992; Walton, 1986).

Deming also sees other obstacles that inhibit productivity and quality, including lack of long-range planning, overreliance on technology to solve problems, seeking examples to follow instead of finding solutions, and excuses (Walton, 1986). Deming does believe in using computers in the work place, however he has observed there is often a poor plan for its use and poor training for its users, resulting in underuse (Walton, 1986).

His fourteen points for quality management contain

many of the basic concepts outlined at the beginning of this chapter. They include:

1. Create a constancy of purpose for the improvement of product and service. He sees the need for innovation, research and education, continuous improvement of product and service, maintenance of equipment, furniture and fixtures, and new aids for workers as being part of this management purpose.

2. Adopt the new philosophy. This is analogous to the creation of a quality corporate culture, mentioned under key concepts, above.

3. Cease dependence on mass inspection. He believes inspection is really only needed to check on the affects of the process improvement methods, such as with the use of control charts.

4. End the practice of awarding business on price tag alone. He sees this as leading to three major problems -- a proliferation of suppliers makes it more difficult to eliminate variation in processes, there is a jump from vendor to vendor, and it causes an overreliance on specifications which he sees as being a barrier to improvement. This point holds tremendous

implications for the NISS, which will be discussed in Chapter 4.

5. Improve constantly and forever the system of production and service. This equates to continuous improvement.

6. Institute training and retraining.

7. Institute leadership.

8. Drive out fear. He believes there is a high cost if workers are afraid to ask questions or offer ways to improve the system.

9. Break down barriers between staff areas. This equates to teamwork or collaboration, discussed above.

10. Eliminate slogans, exhortations, and targets for the workforce. Too often, he claims, management does not provide workers with the means to carry out these schemes. It implies workers can always do better and it builds resentment since current processes won't allow them to do better.

11. Eliminate numerical quotas. Though seen more in production, quotas are frequent in service industry, and even healthcare.

12. Remove barriers to pride of workmanship. One

of the biggest barriers is poor communication between management and workers.

13. Institute a vigorous program of education and retraining. This is to ready and prepare workers for the future of the organization, as opposed to the other point which helps better prepare workers for the current systems.

14. Take action to accomplish the transformation. This action is the PDCA Cycle -- plan, do, check, act (also known as the Shewhart Cycle or Deming Cycle). Plan by studying a process and deciding what might improve it, organize a team, and decide what data is needed and where to get it. Do involves collecting the data via statistical control techniques and implementing a small scale change. Check involves observing the effects. And act involves deciding what was learned and repeating tests as needed (Green & Katz, 1992; Hunt, 1992; March & Garvin, 1987; Sahney & Warden, 1990; Walton, 1986).

As can be seen with this overview of his ideas, Deming's philosophy encompasses most of the key quality concepts and tools. While Deming was famous in Japan

for several decades, his ideas did not attract an American following until he appeared on a television program called "If Japan Can, Why Can't We" in June, 1980 (Dobyns, 1990). Since then, his, and others' quality improvement techniques have gained an ever-widening acceptance among US businesses.

Crosby. Philip Crosby's philosophy of quality resulted from a long corporate career, including inspector and later a vice president position at International Telephone and Telegraph (ITT) for 14 years. He believes most organizations are problem organizations, characterized by:

1. A product or service deviating from published or agreed standards.

2. Extensive field service skilled in rework or corrective action to try and keep the customer satisfied.

3. Management not providing clear performance standards or definitions of quality, so employees can accept them.

4. Management not understanding the price of nonconformance. Products spend 20 percent of sales

dollars reworking mistakes. Service companies spend 35 percent of costs doing things wrong.

5. Management denying it causes the problems (Crosby, 1979; Hunt, 1992). He calls for top level leadership and a major corporate culture change to institute quality, which he sees as conforming to requirements (Hunt, 1992).

For an organization to improve quality, Crosby says the first step is knowing the current "management maturity" in the organization (Crosby, 1979; Hunt, 1992). To assist this effort, he developed the Quality Management Maturity Grid (see Appendix J). The left margin of the grid show six measures of quality management maturity. Across the top are the five levels or stages of maturity -- Uncertainty, awakening, enlightenment, wisdom, and certainty. Once a firm knows its level of maturity, they can incorporate Crosby's fourteen-step program, building and/or reinforcing quality management into the organization (Hunt, 1992). The steps of his program are:

1. Management commitment. This should include a written quality policy.

2. Quality improvement team. He calls for a team consisting of department heads (or immediate representatives) to oversee quality efforts.

3. Quality measurement appropriate for activities performed. His stress on measurement and statistics is not as great as Deming and Juran, however (Oberle, 1990).

4. Cost of quality evaluation. This calls for s financial estimate of costs of quality so areas of improvement can be targeted. He is a big advocate for removing the hidden costs of poor quality and claims that "quality is free" (Oberle, 1990).

5. Quality awareness. Echoes the total involvement concept.

6. Corrective action. Previous steps and employee feedback generate areas and ways for improvement.

7. Zero-defects planning. Unlike other authors, the zero-defect concept is a hallmark of Crosby.

8. Supervisory training so all managers are trained in quality improvement techniques.

9. Zero-defects day. He says such a day should

be planned to let the employees know this is a company performance standard. This would definitely not be a concept of Deming.

10. Goal setting. Again, this is not part of a Deming plan, but Crosby believes each worker should have measurable specific quality goals.

11. Error cause removal. This encourages open communication up the chain of command so employees can notify management of areas needing improvement, without fear.

12. Recognition. Crosby believes nonfinancial recognition should be given to workers who meet quality goals or are outstanding performers. Some would argue this does not encourage exceeding those goals.

13. Quality councils. These are means for quality professionals and team leaders to meet and compare experiences and ideas.

14. Do it all over again. Which is equal to continuous improvement outlined under key concepts (Crosby, 1979; Hunt, 1992; Sahney & Warden, 1990).

To teach his concepts, the Crosby Quality College was founded to train managers on his techniques. In

addition, he formed his own consulting company in 1979 and, like Deming, has written extensively on his ideas, including two books, Quality is Free (1979) and Quality Without Tears: The Art of Hassle-Free Management (1984) (Sahney & Warden, 1990). In addition, he is probably the most successful of the quality writers at motivating an audience with his speeches (Oberle, 1990).

Juran. Dr. Joseph Juran is another major proponent of TQM in America. His education during the first quarter of the twentieth century, was in engineering and law. He worked in government and private organizations, and, like Deming, assisted in the rebuilding of Japan after WWII (Hunt, 1992). Also published extensively, he has done consulting work via his Juran Quality Institute, established in 1979 (the same year as the Crosby Institute) (Oberle, 1990; Sahney & Warden, 1990). Like the authors discussed previously, Juran feels American business has undergone a quality crisis. He sees two main reasons for the problem -- managers do not accept responsibility for the functioning of the organizations, and that they do

not realize the cost of continued poor quality (Juran, 1986; Juran, 1988). Basically, these assumptions do not differ from Deming and Crosby. But his 1951 book, Quality Control Handbook helped show the great costs -- especially hidden costs -- of poor quality (Garvin, 1987). These costs are outlined in Appendix K). And he defines quality as "fitness for use", stressing the need for the end product or service to meet customer expectations (Garvin & March, 1987; Oberle, 1990). This fitness for use has five measures -- quality of design, quality of conformance, availability, safety, and field use (Garvin & March, 1987). This emphasis differs somewhat from Deming who defines quality more in terms of the process, than the final outcome. He also doesn't see anything wrong with adding a little fear into employees' lives since it might bring out good results (Oberle, 1990).

The basis of his quality program is the Juran Trilogy -- quality planning, quality control, and quality improvement (Hunt, 1992; Oberle, 1990). Planning involves the steps he outlines in his quality planning road map (see Appendix L). An organization

prepares to meet quality goals and establishes a process that can best meet those goals. Quality control involves insuring that the goals devised in the first step are actually being met by the product or service. Quality improvement, unlike the other two steps, focuses on making changes to parts of the process, rather than focusing on the whole outcome. When an organization first installs the Juran Trilogy, he advocates the following breakthrough sequence:

1. Breakthrough in attitudes.
2. Identify the vital few projects (the eighty-twenty rule described in the key concepts section above).
3. Organize for breakthrough in knowledge. This involves a steering group to define problems and possible causes and a diagnostic group to analyze specific problems.
4. Conduct needed analysis.
5. Determine how to overcome resistance to change.
6. Institute the change.
7. Institute controls (to monitor and follow-up

on solutions).

The above three authors -- Deming, Crosby, and Juran are the best known of the quality "gurus", however there have been other major contributors to quality thinking. Several are presented below.

Costello. Robert Costello's role in TQM was as its implementor and molder of the program with the Department of Defense. Building on the work of Deming, Juran, and Crosby, he helped construct the Defense Department's TQM model (see Appendix M) and TQM master plan (see Appendix N) (Hunt, 1992).

Ishikawa. Kaoru Ishikawa was the best known of the Japanese quality authors (he died in 1989) (Crawford-Mason & Dobyns, 1991). His father worked with Deming when he came to Japan after the war, and he himself urged statistical methods of quality control starting in 1949. He is attributed with the concept of quality circles, which are widely used in Japan (Crawford-Mason & Dobyns, 1991). His book, What Is Total Quality Control ? (1985) outlines the history of quality control in Japan and Japan's belief that top management must be an active facilitator and

participant, and that quality implementation takes a very long-term commitment.

Others. There are many other authors of quality management principles. Readers are referred to Hunt (1992), Crawford-Mason & Dobyns (1991), or Backaitis & Rosen (1990) for excellent bibliographies and resources.

Use of TQM in Business

As mentioned, WWII war production plants were the first to utilize Deming's quality management principles. However, use of TQM among American businesses took a hiatus until the 1980's. The post WWII American business boom gave little incentive for American companies to make the long-term effort to commit to quality improvement. During those intervening three decades, post WWII Japanese businesses were reaping the benefits of the quality experts such as Deming, Juran, and Ishikawa (Crawford-Mason & Dobyns, 1991). There were pockets of quality improvement efforts in America during this time, such as the change in corporate culture and zero-defect initiatives at Martin Company, makers of Pershing

missiles (Garvin, 1987). These pockets were few and far between, however.

Between 1970 - 1980, American business competitiveness was taking a turn for the worse and companies were more ready to listen to Deming's message (Sahney & Warden , 1990). A 1981 survey found that almost 50 percent of American consumers felt the quality of US products declined during the preceding five years (Garvin, 1987). Executives saw that Japanese product and service quality ratings were above their own in many areas (Berwick et al., 1991). Deming's television appearance in 1980 was timely and very well received, and he and other quality experts became involved in instituting quality improvement in American organizations (Garvin & March, 1987). Ford Motor Company began to adopt the Deming method in 1981 (Oberle, 1990). Semiconductor companies, after studying the lack of defects in Japanese products, also changed to quality improvement strategies (Garvin, 1987). The decade of 1980-1990 saw ever-increasing adoption of quality improvement in manufacturing companies (Sahney & Warden, 1990).

Initially, production companies adopted TQM -- especially those with successful overseas competitors (Geber, 1990). However, in the last several years, service companies have finally acknowledged the potential from implementing TQM in their firms (Albert, 1989). There is an abundance of success stories in the literature where adoption of TQM techniques have meant increased productivity and success in the market place -- AT&T, Burroughs, Campbell Soup, the DOD, Ford, Johnson & Johnson, Mobil Oil, and Xerox are just a few (Berwick et al., 1991; Clausing & Hauser, 1988; Davidow & Uttal, 1989; Heskett & Schlesinger, 1991; Hunt, 1992; Sahney & Warden, 1990). A report by the General Accounting Office (GAO) found that organizations that adopted TQM techniques did, indeed, improve overall corporate performance whatever the size of the corporation (Koska, 1991). And national quality awards, such as the prestigious Baldrige Award are becoming more highly prized (Crawford-Mason & Dobyns, 1991).

Use of TQM in Healthcare

Healthcare organizations are facing a crisis, much

like that manufacturing companies began to face in the 1970's. Increased competition and "for-profit" medicine, rising malpractice costs and defensive medicine costs, consumer complaints about the rising costs of healthcare, and outside regulatory pressures are all leading to a need to adopt quality improvement practices (Berwick et al., 1991; Lehmann, 1987; O'Leary, 1991). While quality improvement is being used, it is still rare to find great breakthroughs in the field (Eskildson & Yates, 1991).

The National Demonstration Project on Quality in Health Care (Berwick et al., 1991) and several papers and articles provic excellent examples of how quality improvement techniques can and are being implemented in healthcare organizations in America (Anderson, 1992; Bradley, Brett, & Tonges, 1990). And as was mentioned, the JCAHO, through its Agenda for Change (first initiated in 1985), is promoting quality improvement efforts throughout the industry (Green & Katz, 1992; Koska, 1991; Lehmann, 1987; O'Leary, 1991).

Some believe implementing TQM in healthcare may be very difficult because every patient is different --

there is no "standard" product. There are also beliefs that the doctor's decisions still determine quality, that our society is still too individualistic, physicians are not "team" players, healthcare quality is too obscure to be measured, and that quality costs (Berwick et al., 1991). Fortunately hospitals are slowly showing these assumptions are not necessarily true.

A 1991 survey of 351 hospital quality assurance personnel found that 95.2 % were aware of TQM concepts and that 70.7 % stated there was at least some quality improvement activity, separate from QA, within their organization (Koska, 1991). But only 15 % had been involved in TQM for over two years (Koska, 1991). And it is still rare to find both the customer and supplier of healthcare working together on quality improvement (Berwick, 1989). Hopefully, more wide-spread use of TQM in healthcare will soon become the norm.

Pros and Cons of TQM

To this point the good points of TQM have been expounded. The success stories, as mentioned, are becoming increasingly easy to find in the literature.

But are there drawbacks to TQM implementation? Some authors think there are.

One author feels that professionals, perhaps including physicians, researchers, and lawyers will reject the concepts of error-free, zero-defects performance (Geber, 1990). However, not all TQM authors share this philosophy. A Deming-like approach might work best in such organizations. Such professionals also might feel their code of ethics is in direct conflict with some customer expectations, or that their work simply cannot be thought of as "processes", thus rejecting TQM (Geber, 1990).

Organizations can also run into problems when they use TQM measurements to reward individuals. Lying and/or breakdown of collaborative efforts can occur (Geber, 1990). And some aspects of quality may simply be very difficult to measure. In addition, some still are looking at TQM as a quick-fix to problems (Koska, 1991).

P. McLagan (1991) wrote of the "dark side" of quality and describes three potential problems. The first, she calls process rigor mortis, in which every

minute work process is routinized and measured. Closed-loop thinking is another identified possible problem. McLagan feels innovative breakthroughs may be hampered while efforts to measure and improve current processes are fostered. Finally, she sees a real potential for team overkill that results in individual worker needs going unmet. She feels that until areas such as performance appraisal management, management information systems, job training, reward systems, and job design are changed to reflect and better integrate with quality management, TQM efforts may not be productive. Other authors have also written of the problems that can be encountered with TQM (Newman, 1991; Zemke, 1992).

The biggest problems this author sees are when only some of the necessary concepts are implemented in a TQM program. For instance, if workers are encouraged to partake in teamwork, yet the old individualistic, line manager performance rating system is in place, confusion and apprehension may occur.

Summary

In this chapter, the key concepts, tools, and the

history of TQM have been presented. These topics must be understood so the NISS can adapt and apply them to enhance the quality of nursing information systems.

CHAPTER 3

Application

Systems Life Cycle

Information system specialists work in a variety of roles, performing a plethora of functions. Inevitably, those roles and functions correspond to, or interact with, one or all of the stages of the Systems Life Cycle (SLC). The SLC is a set of developmental phases through which all information systems advance. Depending on the system, the phases may flow one after the other, or some phases may run in parallel. There may also be occurrences when the SLC reverts to a previous phase when problems are encountered. The life cycle outlines the activities involved in all phases and is used by information systems specialists to insure all necessary tasks are addressed in system design and development (Ahituv & Neumann, 1990). The SLC is used here to structure the potential application of TQM by information systems specialists -- including Nursing Information Systems Specialists (NISS).

There are as many descriptions of the life cycle as there are authors on the subject. Most agree on the

general processes, though there is disagreement in terminology. This paper uses the terms, phases, and activities delineated by Ahituv and Neumann (1990). They give the following outline of the SLC:

1. Definition phase.
    (a) Preliminary analysis.
    (b) Feasibility study.
    (c) Information analysis.
    (d) System design.
2. Construction phase.
    (a) Programming.
    (b) Development of procedures.
3. Implementation phase.
    (a) Conversion.
4. Operation phase.
    (a) Operation and maintenance.
    (b) Postaudit.
    (c) Termination.

A brief description of each of these phases follows, as well as how TQM concepts can be applied.

Definition Phase

During the definition phase, the information

problem is defined and solution specifications identified. There are four main processes involved.

Preliminary analysis. The life cycle usually begins when an end-user and/or management (who may also be end-users), or a vendor see a need to improve information processing (Priest, 1989). Perhaps the need was envisioned in a master plan for information systems development, or because users perceived an information problem (Ahituv & Neumann, 1990). The preliminary analysis helps clearly define the problem statement and assists in planning a thorough examination of the problem.

To help clarify the problem and information needs, data collection can be done via interviews, surveys, observations, and studies of the current system (Priest, 1989). Use of TQM principles can be extremely beneficial in insuring the true problem and needs are identified. Top level management should already have a commitment and strategic plan for quality improvement throughout the organization, including mission, vision, and long-term goals. An interdepartmental quality team could be organized as an information problem/need is

first noted. All too often, an information system is planned for a particular department with little input from outside that department, or end users are not consulted during the early needs assessment (Simpson, 1991). A collaborative team should include not only end users, but other customers of the system output. If a vendor is initiating the SLC, they should consult end users, as well. When forming the team, it should be asked "who might be affected by this process improvement" and "who might use the output of the improved system." The understanding that a hospital is an interdependent system is imperative (Priest, 1989). Almost everything that nursing or any other department does to change its information processes will impact other departments in some way. The team members must then begin training, if not already done, on TQM and group techniques. Training might also be needed to familiarize members with each other's work. For instance, nursing members may need an introduction into information system technology and information systems specialists may need some familiarization on information handling techniques used by nurses. For

nursing systems, an NISS can help bridge this gap in knowledge.

As the problem is then studied by the information quality improvement team, quality improvement tools can help assure the true nature of the system and problem is understood. Data collection tools such as process flow diagrams, checksheets, bar charts, histograms, brainstorming, cause and effect diagrams, Pareto charts, and run charts can all help structure the problem definition done during preliminary analysis. For instance, data can be collected on frequency of use of a particular information item, or who uses the information. Data can also be collected on how the current system impacts quality of care, so it can later be compared with post implementation data to help define system benefits and costs. Data collection from customers is also essential -- both internal and external customers. Are customer needs being met by the current information system? What is the information need from **their** vantage point? Surveyed customers may include patients, end users, and other hospital department personnel. The TQM concept of

total involvement is important in this activity to insure the team focuses on the real information problem and need. Equally important is the need to focus on long-term quality improvement. Is the need being addressed a temporary one that will vanish with the next set of government or JCAHO regulation changes? Information system changes usually take time to develop and implement. Or is the need one of the "trivial many" that will not really affect the overall quality of patient care? What are the quality costs of improving or **not** improving the system? Focusing on true quality process improvement in information systems is essential during this preliminary analysis.

TQM principles recommend a strong partnership between vendors (suppliers) and customers. Though seen infrequently at the current time, a medical organization may establish this on-going relationship with a particular information systems software and/or hardware vendor (and vice versa) (Simpson, 1992). If done, the process improvement team can take advantage of the outside knowledge base, and they can assist each other in improving information systems efforts.

The end result of this SLC phase is a preliminary conceptual report for management, in the user's and customer's language. This report should include a definition of the problem; a brief summary of information requirements resulting from the problem; information recipients; frequency of the required information; inputs to the system; and the scope, boundaries, and objectives of the information system (Ahituv & Neumann, 1990).

Feasibility study. Once the decision is made to proceed with information process improvement, a feasibility study is done to determine whether a particular project should be done, and if so, how, and is it feasible (Ahituv & Neumann, 1990)? Who, what, when, where, how, and why should be guiding the feasibility study (Priest, 1990). Specific questions asked and answered during this activity are outlined by Ahituv & Neumann (1990), but are modified below to include quality issues. They are:

1. What problems or process improvement needs are addressed by the new information system?

2. Is there available technology and know-how to

improve the information process?

3. How will the system be accepted by users/customers? What are potential acceptance problems?

4. Do the potential quality and financial benefits outweigh the quality and financial costs?

5. Does the system support the organization's quality improvement master plan, vision, and goals?

6. How should the development proceed?

The feasibility study is essential because few organizational resources are consumed up to this point in the SLC. If the study results in progressing with the project, human and financial resource commitment becomes much greater. Too often in system development, departments decide what they want to do first, and write a document justifying their approach (Ahituv & Neumann, 1990). Employing TQM principles during this study can insure proper resource utilization.

Once again, TQM's measurement and statistical tools can help find potential causes of the information problem and possible information solutions. A process flow diagram helps show what steps can be eliminated,

combined, changed, or simplified (Priest, 1989). Brainstorming, data collection and display, cause and effect diagrams, run charts, Pareto charts, etc can all help recognize problems, causes, and potential solutions. Again, acknowledging the interdependence of hospital systems, including all people potentially affected by the processes under study, and focusing on the customers is vital. This may be an excellent opportunity for management to show their commitment to quality by actively participating in the studies and giving staff additional training needed to carry out TQM principles. This is also the time when a team may decide to engage in benchmarking activities to see how other departments, hospitals, vendors, or non-hospital organizations tackled similar information process problems with excellent quality results.

The end result of the feasibility study is the feasibility report presented to management to aid in determining whether to proceed with the recommended project. The report should include all alternatives considered, the reasons and data supporting the recommendation of one alternative, and how

implementation of the process improvement plan will be achieved (Ahituv & Neumann, 1990). Solutions must be consistent with meeting customer needs and supporting management goals. If management has been involved in the process improvement activities, the decision will be easier to communicate.

Information analysis. The information analysis (sometimes called systems analysis) is the next definition phase in the SLC (Ahituv & Neumann, 1990; Priest, 1989). This is when functional specifications needed to meet requirements of the above activities are determined. There are four major areas of this analysis: (a) in-depth examination of the current information system, including what happens; (b) information requirements, including why the present system needs improvement; (c) conceptual design for the new information system; and (d) the project plan (Ahituv & Neumann, 1990). The project plan usually contains the following elements:

1. Overview of the project, including the objectives.

2. Activity plan.

3. Organization plan.

4. Resource allocation plan.

5. Staffing plan, including a work breakdown structure.

6. Budget.

7. Monitoring and control techniques.

8. Training plan.

9. Documentation plan.

10. Test plan.

11. Installation plan.

12. System change plan.

13. Project schedule (such as Gantt and PERT charts).

14. Project termination plans (Ahituv & Neumann, 1990; Mantel & Meredith, 1989). Project management textbooks, such as Project Management: A Managerial Approach (Mantel & Meredith, 1989) are recommended for further information on project planning techniques.

TQM techniques can continue to be applied during this phase of the life cycle. The team approach should continue, with extensive user, customer, and vendor involvement (if feasible). Use of TQM tools, such as

surveys and the Pareto diagram, can help gather data on what are the essential information requirements, as opposed to the "nice to have" elements. The team must remember that their goal is process improvement -- not just automating an existing manual information system, as frequently happens. There is always room for improvement, and innovative thinking should be encouraged. Again, reviewing the process flow diagram and identifying steps in the system for change is encouraged. Top management should also show their trust in the staff's ability to work hard at finding the true user and customer needs. They must show their commitment by giving the necessary resources, including time, to take part in process improvement efforts. If additional team training is needed, this, too, should be supplied. Benchmarking may also be productive during this phase.

The outputs of this SLC phase are the systems analysis report, containing the proposed solution in detail, and the project plan. Both are presented for management's approval to determine whether to proceed.

System design. Actual system design may also take

place in a medical setting, by the vendor, or a combination of the two. This is the most challenging and creative part of the SLC (Priest, 1989). It involves developing the programming specifications to guide the programmers with system development; and planning for user training, system and acceptance testing, and conversion to the new system. The system designer(s) receive the systems analysis report and use it to plan how best to fulfill its requirements. The main activities performed include:

1. Design of system inputs.
2. Design of system outputs.
3. Design of system files and databases.
4. Design of system processing methods.
5. Preparation for programmers and procedure writers.
6. Presentation of the system design to management and users for approval (Ahituv & Neumann, 1990).

A prototype (model) of the proposed system is often made during this phase to assist users and designers in further evaluating system needs. This

stage involves more technical specification writing than the previous phases. The design may have already taken place in a vendor setting. Often a medical facility will buy an existing system and have it tailored to meet their needs or use it as is (a turn-key system). Either way, the proposed system is divided into modules and programs within modules. Then the following specifications for each program is detailed:

1. Raw data sources.
2. Inputs.
3. Files; their organization, storage, processing, size, and access methods.
4. Processing.
5. Outputs.
6. Testing and conversion.
7. Information flow (Ahituv & Neumann, 1990).

Once more, TQM principles can help improve the quality of the efforts. A team approach draws on expanded knowledge sources, with a partnership approach between users, customers, and vendors doing likewise. Top management involvement and support help the team

recognize the importance and value of their work. Surveys, observation, and data collection tools may still be of use in identifying important inputs and outputs for the programs. And benchmarking can continue to be of use to the team, to see how successful information systems handled similar problems. System controls should be designed into the system to help automate future data collection on system quality performance.

Equipment needs are also identified during this stage to see if current hardware is sufficient or in need of change. If the medical facility is the principle initiator of information system change (as opposed to a vendor developing a system through a perceived need), the Request for Proposal (RFP) is completed during this phase of the SLC to elicit bids from vendors, identifying functional and system specifications and hardware, training, and conversion needs. A vendor is then chosen which best meets the needs, while staying in the proposed budget. In a TQM environment it must be emphasized that the contract does not merely go to the lowest bidder. A poor

quality product or one not meeting customer desires and expectations may cost much more in the long-term than a more expensive, but effective product. The costs of poor quality -- often hidden -- must be on the mind of the team selecting a vendor.

Also written during this stage, often by the vendor or in conjunction with them, is the system design report. It includes:

1. Flow charts of the system and programs.
2. Data dictionary.
3. Matrices describing interrelations between inputs, files, and outputs.
4. Documents, forms, records, outputs, and screens.
5. Data validation tests.
6. Program narratives.
7. Specifications for writing procedures for use of the system.
8. System test plans.
9. File construction and maintenance plan.
10. System installation plan.
11. System change plans (Ahituv & Neumann, 1990).

Again, management and users must concur with these plans and whether to proceed with the construction phase.

Construction Phase

The construction phase involves the development of the new system. There are two main processes involved.

Programming. Once the system design phase is complete, construction of the actual information system can begin. Programming entails the coding and testing of computer programs to meet the system requirements (Ahituv & Neumann, 1990). While the programmer is the main person involved in this activity, those who designed the system and/or will be its customers should have continuous communication feedback to help insure successful development. This may be more difficult for systems constructed by vendors rather than in-house, but is essential. Medical software vendors are hiring an increasing number of experienced medical professionals who can assist with the design and programmer feedback. Some vendors are also beginning to invite potential user-customers to comment on system prototypes and give feedback to designers and

programmers (M. Douglas, personal communication, March 3, 1992). Once written, each program of the system is tested individually and needed corrections made before system testing is done. Thorough documentation is done to assist future use, understanding, and changes to the system (Ahituv & Neumann, 1990; Priest, 1989). The documentation often includes a narrative description of the purpose and solutions, a logic display (often a flow chart), the source program listing, input and output layouts, test data, and operator instructions (Ahituv & Neumann, 1990).

TQM concepts continue to have importance. By focusing on customer needs and eliciting customer feedback, the programmer can help assure a quality product. Use of prototypes or structured walk-through between programmers and users, where the system is explained and users critique the system, can be extremely beneficial (Priest, 1989). Measurement and statistics can also gather data on the system and insure it functions within expected limits. Some programs (laboratory machine interface programs are noted for this) can have built-in control mechanisms

which will alert users when outputs fall outside an expected range. This is equivalent to having a control chart built into the system. Any changes to the system should be thoroughly tested, and data gathered, to insure the entire system continues to meet expectations. The concept of the interdependence of the system should keep programmers and users alert to the possibility that a change in one place of the system can have unexpected results to total system performance. Benchmarking can continue to assist those involved in the construction phase, though copyright infringement laws must be adhered to.

The outputs of this phase of the SLC are the programs, with accompanying documentation; and operators and input entry manuals (Ahituv & Neumann, 1990). If good project planning techniques were employed, users can monitor the progress of development at this and other phases, by comparing the original project schedule with timing of reports and completion of tasks. Data collection and display via TQM tools can help show this progress and alert the process improvement team of real or potential problems.

Development of procedures. The programming phase above results in computer instructions, while the procedure phase of construction results in human instructions for system interaction (Ahituv & Neumann, 1990). Users and information analysts (possibly an NISS) usually work with a system designer on this phase of the SLC.

The procedures (including user manuals) must be written in the user's language, so this process requires a strong customer focus. Benchmarking can also assist in quality procedure development. Perhaps certain manual approaches elicit praise among other systems' users. Those styles could be duplicated to produce high quality written guides. A team approach, with brainstorming and other collaborative techniques can also assist in improving the quality of procedures. Acknowledging the importance of sound training approaches in writing training manuals is imperative. All too often, user training needs are not met because of the low emphasis placed on this customer need. Another problem often encountered are unresponsive procedures for processing users' system change

requests. TQM implies procedure writers will institute plans for effectively processing these requests by streamlining user-vendor communication and soundly documenting and responding to such requests in a timely manner.

User guides, operator guides, training manuals, system change request procedures, and other needed manuals, all result from this phase of the SLC.

Implementation Phase

Implementation involves installment and use of the new system. Conversion is the term used for this.

Conversion. Conversion consists of three main processes: (a) training new users and operators, (b) installing the new system, and (c) acceptance testing by users (Ahituv & Neumann, 1990). This phase is complicated when the system is replacing current information handling, as opposed to implementing totally new processes. This is due to the parallel operation that usually must ensue. Often facility changes must be made, in addition to building new files and tables or converting old ones to the new system. Training of new users must occur before activation, yet

not be to soon before use commences. If there is a long lag time between training and activation, knowledge may be lost. Juggling needs of the work schedule with system training needs also poses special challenges. Acceptance testing should also be done by users to insure the system is ready for active use and any last minute changes are communicated to developers. TQM concepts of importance include customer focus, collaborative efforts, benchmarking, and measurement tools. Maintaining a customer focus means soliciting their input and assessing their needs before conversion plans are finalized and carried out. Who will be affected by training and activation? How can negative effects be minimized? Perhaps user classes need to be given after routine duty hours to accommodate shift workers. Do services need to be scheduled differently to give staff time for training? Are training facilities conducive to adult learning? Who will supply work center staff support during activation? Is adequate time being given for new users to learn and become familiar with the system before a decision is made on its effectiveness? How are patients and other

organizational staff affected during conversion? Are their needs being met? Is security, privacy, and confidentiality of information sufficient? Is there adequate back-up and storage of information? Experience has shown this phase is not always well planned to meet user and customer needs. A collaborative approach can continue to help by drawing on an expanded knowledge source. Perhaps certain team members are more experienced in conversion than others, even if they are not primary users of the new system. Benchmarking to learn how others have successfully converted to similar systems can also be helpful. Measurement tools can greatly assist in beginning to collect post implementation data to analyze system benefits and costs. They can also gather data on the actual conversion efforts to help staff and vendors assess conversion strategies employed. For instance, was it best to implement one unit of a department at a time, or should all units be activated at once? Did trainers meet the needs of trainees? There are numerous areas for possible data collection and display to learn from the conversion process.

While no particular documentation output is required from the conversion efforts, Ahituv & Neumann (1990) suggest keeping a conversion log for future reference. In addition, a project report may be given by the process improvement team to management, including statistics on adherence to the project plan (was the project on time, on schedule, and did the system meet performance objectives).

Operation Phase

The operation phase is the last phase of the SLC. It involves not only actual operation of the new system, but on-going evaluation and eventual change. There are three distinct processes involved.

Operation and maintenance. Once the system is converted, it operates at processing information and requires continuous maintenance. Maintenance involves correcting errors not previously encountered; adapting when other interrelated systems change; and continuous improvement, utilizing new technology advances and implementing new system change requests by users or system upgrades by developers (Ahituv & Neumann, 1990). Built-in system controls can help detect the

reasonableness of outputs (Priest, 1989). Maintenance to procedures is also needed. Future users and operators must know their manuals continue to be applicable.

A customer focus and emphasis on continuous quality improvement means responsive maintenance and upgrading of the system. Developers should not rest on the laurels of a successful conversion, or point blame at an unsuccessful conversion. Conversion and operation are processes, like other facets of the SLC, and improvements can always be made. Therefore on-going user groups (or process improvement teams) and data collection is essential to assist with quality operation and maintenance. Operators and developers must be responsive to appropriate change requests. Before implementing such requests, how the change affects other processes must be understood, perhaps via new process flow diagrams, brainstorming, cause and effect diagrams, and other data collection tools. On-going training will be needed, and management must allocate resources and support these continuous training needs. Involving all users, not just user

groups, in collecting data and looking for improvement areas can also aid in maintaining a quality process.

Maintenance logs are the primary output of this phase of the SLC. The logs are an account of all problems and changes made to the system. System change requests log, updated manuals and procedures, and new program codes are also produced during this phase.

Postaudit. Postaudits are recommended at periodic intervals, starting at three to six months after activation (Ahituv & Neumann, 1990; Priest, 1989). The main purpose is to determine if planned objectives, scope, costs, and benefits were realized.

TQM principles imply this should be a continuous process. It also implies that not only should postaudits be done to compare the system against planned performance, but on-going analysis of ways to improve the system must be done. Benchmarking can assist in finding ways of system improvement, as well as attendance at information system meetings, class attendance by personnel, literature searches, on-going user and customer surveys, and on-going data collection of system performance. When benchmarking, it is

important to observe not only other users of the same or similar systems, but users of different systems who tackled similar information problems. TQM measurement tools can help accomplish and analyze data collection efforts. Successful conversion does not mean a process improvement team is no longer needed, though team members may change at this point.

Postaudits can take the focus on direct and indirect benefits produced by the system, direct and indirect quality and financial costs, evaluation of system outputs, evaluation of system personnel, and evaluation of top-management involvement (Ahituv & Neumann, 1990). A one-time postaudit report containing the above is usually recommended, but in a TQM environment, this report should contain provisions for on-going quality improvement efforts.

Termination. When errors, data, and change requests imply the system is no longer feasible, the system is slated for termination while a new system life cycle is begun (Ahituv & Neumann, 1990). Termination is usually not completed until the new system is activated. Management must use user and

customer feedback, as well as objective quality data when making the decision to terminate.

Potential Application of TQM in NIS's

There is tremendous potential for using TQM to improve the quality of nursing information systems. Nurse information specialists and system users can become involved in all stages of the system life cycle, as outlined above, and utilize the TQM techniques appropriate for that phase. The NISS may work for the vendor, be an outside consultant hired by a medical organization, be a member of academia, or be a direct employee of a medical organization. Working for a vendor may involve research and development, installation, training, sales and marketing, or management. Outside consultants may be hired for any stage of the SLC -- from preliminary analysis to postaudit benefits analysis. NISS's may teach and develop other NISS's or do research in academia. NISS's working for medical organizations can become involved at all stages of the SLC as well. Wherever the NISS is employed, TQM principles should be known and employed by the NISS for three main reasons:

1. To improve the quality of nursing information systems.

2. To improve the management of NIS departments and NIS's.

3. To assist with TQM implementation and use throughout the agency.

CHAPTER 4

Summary

Conclusions

Total quality management (TQM) and continuous quality improvement (CQI) techniques have shown enormous potential for improving the quality of products and services. Most healthcare organizations are still using the old quality assurance approaches to quality -- reactive inspection, rather than proactive prevention. Increasing healthcare costs and questions about the quality of services have led many, including the JCAHO, to look for ways to improve health care in America. TQM/CQI is finding an increasing following in the medical community and has helped improve services at several facilities (Anderson, 1992; Berwick et al., 1991; Blacharski, Hagstrom, and Stratton, 1991; Darr, 1989; Jeffer, 1991). The information systems literature is also beginning to expound on the positive impact on quality that TQM can make in information systems, including healthcare information systems (Kolence, 1991; Margolis, 1991; Perry, 1991; Spitzer, 1991; Ummel, 1991).

Need for Nursing Information Systems Specialist (NISS) to Study Total Quality Management Principles

After reading about the potential for TQM in healthcare and information systems; its infrequency of use; the current questionable quality of nursing information systems; and the lack of nursing involvement in NISS selection and development (Dunbar, 1992); it is concluded that NISS's can begin to improve the quality of information systems by studying TQM principles and techniques. They can begin by reviewing the literature, attending one of the numerous classes and conferences offered on TQM, attending quality institutes, or participating in quality improvement teams. Once trained, NISS's are encouraged to actively put TQM into practice.

Implications

The implications for NISS use of TQM falls into three main categories: (a) potential to improve the quality of nursing information systems, (b) potential for improving management of NIS's and management of NIS departments and agencies, and (c) to assist their healthcare agency in implementing TQM throughout the

organization. These implications are addressed below.

Potential for Improving NIS's

Experience and the literature show unmet promises of effective nursing information systems improving the quality of patient care. The NISS must utilize TQM to improve the quality of systems throughout the systems life cycle.

Focusing on the users' and customers' needs and expectations, rather than those of the information systems department, is an imperative. Sound objective measurement and statistics, as promoted by TQM, can assist in assuring the important requirements are identified and the best solution is found. A collaborative approach must be utilized, with productive group techniques to collect data, identify possible solutions, and put the solution into practice. This team must include end users and staff from other functional areas which may be impacted by a new NIS. Understanding the interdependence of systems is vital for recognizing all who may be affected. Benchmarking of quality NIS's, as well as other organizations utilizing useful systems to meet similar information

problems, can assist the team to find more effective systems. Insuring adequate training of all system users and actively soliciting their feedback for system improvements can greatly enhance system quality. It must be remembered that customers and end-users account for the most productive process improvement suggestions (Hunt, 1992). Total involvement is encouraged and no suggestions should be bypassed without thorough investigation. TQM also calls for constancy of purpose. The NISS can help enforce this concept by always keeping the system's goals and objectives in mind, and insuring they support that of the organization. They also must insure top-level commitment to the information process improvement efforts. At the same time, as noted by Deming (Walton, 1986), new technology is not always the answer to a need for process improvement. The NISS must be open to recognizing when information systems can be a cost effective (financial and quality) means of improvement, and when they are not.

Potential for Improving NIS Department Management

As mentioned above, the NISS may be employed in

various settings. Because of the specialized nature of the job, management responsibilities for a department or work unit are often assigned. If the NISS adapts TQM principles in managing their work area, improved quality of their services will hopefully result.

First, the NISS must insure top-level management will support quality improvement efforts. Then a TQM plan should be written, including a commitment to quality and a sound vision for the work unit. That vision must be shared with all workers and their total involvement in quality improvement encouraged. Training must be given to workers in TQM techniques, with a reward and recognition program that acknowledges team quality improvement efforts. Trust in workers ability to want to improve quality is another tenet to follow in managing the department. Open communication and managing by "walking around" is a must. The customers and their needs and expectations must be the center of quality improvement efforts, with the department having a responsive plan for addressing customer requests. The results of a better managed unit should be improved systems and system user

support.

Potential for the NISS to Assist Agency with TQM Implementation

Another major implication of NISS's knowing and utilizing sound TQM skills is their potential to then assist their organization to implement TQM throughout the organization. Information systems can benefit in the vast data collection endeavors TQM requires (Fifer, 1987; Patterson, 1990). Systems should be designed and implemented that will support such efforts. Built in controls and exception reporting can assist users in knowing when outcomes fall outside an expected range. An integrated system or a standards-based open architecture system will support the information sharing needed between departments for collaborative process improvement ventures. Systems can also be implemented that are specifically tailored to supporting TQM activities. They may support brainstorming and group activities (like Groupware), or statistical process control. In addition, the JCAHO has been developing standards for information systems to support hospital CQI (Patterson, 1990; Shanahan,

1988; Skjei, 1989; Spitzer, 1991; West, 1990).

Spitzer (1991) outlined the specific needs of a hospital information system to enable it to support quality efforts. Nursing systems must support the capture of such data, including orders and results, alerts to results outside normal limits, patient care documentation, schedules and scheduling ability (for staff and patients), policies and protocols, service performance norms, reference information (including access to outside sources), tracking performance results from the customer's perception, reliability of processes compared to standards, service and task-level audit information, information for visitors, offsite communication capability by physicians and others, knowledge-based support for clinical decisions, trending and tracking across cases and encounters, good statistical and presentation tools, capture of patient outcome indicator results, automated support for patient notifications and education, providing views of above across normal hospital boundaries, support monitoring of supplier performance, access to population demographics and health statistics, and the

ability to compare organization's performance on different levels with competitors. Obviously a nursing information system alone cannot meet all of the above recommendations, but the NISS can work across normal functional boundaries to support automating data needed to improve quality throughout the organization.

Recommendations

Training in TQM Principles and Techniques

As mentioned above, the NISS must become trained in TQM principles and techniques, support training of other workers in TQM, and should also actively train staff in TQM, once proficient. As an adult learner and a professional, it is the responsibility for the NISS to seek opportunities for such training rather than wait until it is offered. As mentioned above, there are numerous sources for training. Before training is sought, the NISS should know the organization's stance on TQM/CQI. Hopefully management will support such training and may already have plans to do so. If not, the NISS can become an educator for management and set an example for others to follow. Just as quality improvement is a continuous process, so is training in

TQM. The NISS should keep abreast of literature findings and utilize proven techniques.

Establishment of a TQM Plan

A framework, in the form of a TQM plan is recommended to guide implementation of TQM. If the organization has such a plan, the NISS should write one for the NIS department that supports corporate visions and directions. The plan should include the vision and goals of the program (that all actions are guided by TQM principles), plans for staff (including self) training in TQM, participation of staff in TQM planning, strategic issues selected for beginning improvement efforts (agreed on by staff and customers), plans for tracking improvement efforts, plans to break down all barriers of open communication (horizontal and vertical), team guidelines (and how to support interdepartmental teams) and recognition for team efforts, resources for implementing TQM, how to foster total involvement, basing more decisions on facts and statistical data, definition of quality, and proposed measures of quality from the customer perspective.

Summary

Total quality improvement is a management strategy with great potential for the NISS. Through training in TQM and implementation of a thorough TQM plan; the quality of nursing information systems, NIS department management, and the organization's total quality improvement endeavors can all be improved.

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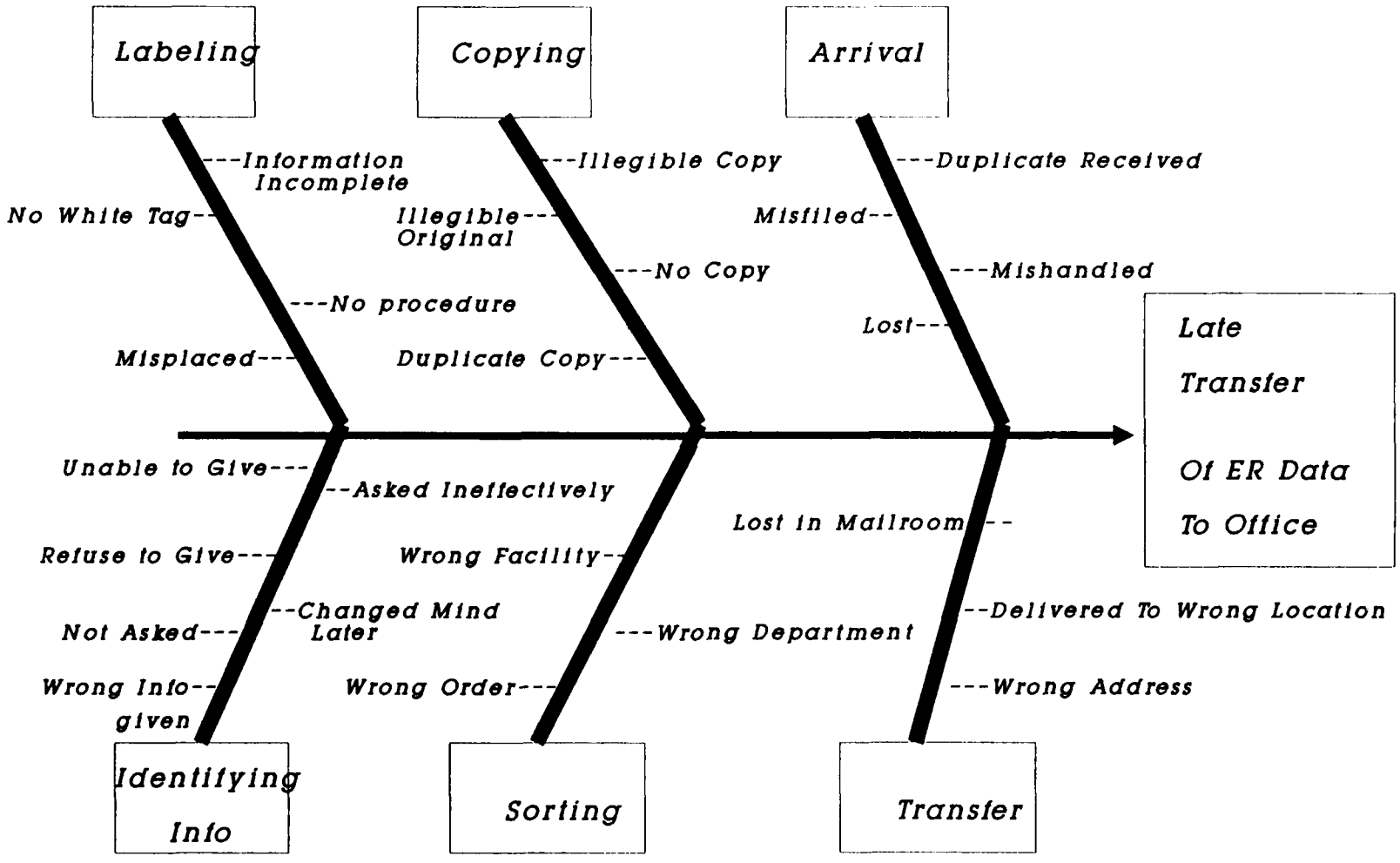
Appendix A

Cause - and - Effect Diagram



Appendix B

Checksheet

Reasons for Calls to NIS Office

Product: Hospital Information System

Dates: January 1, 1992

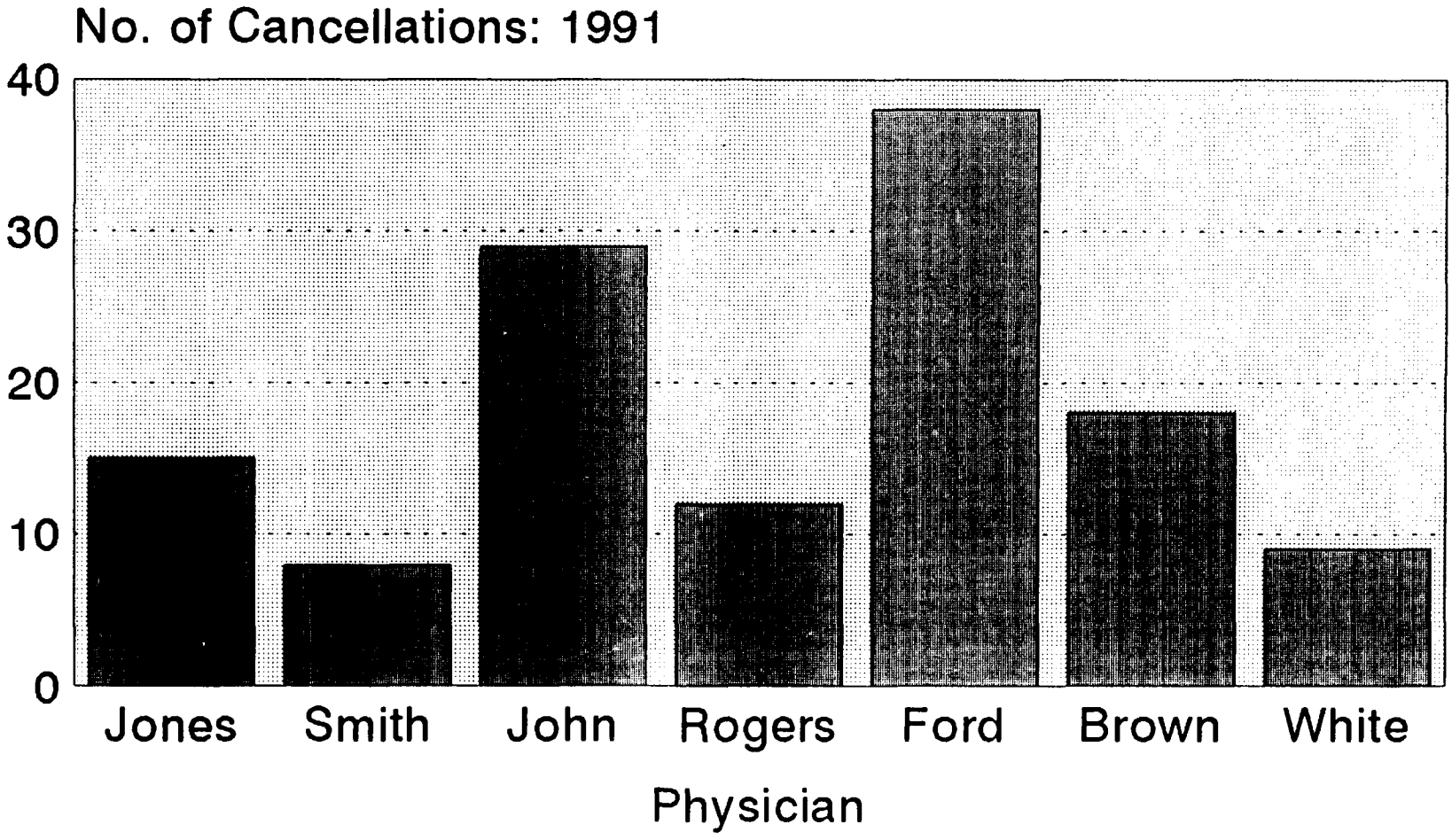
Total Calls: 19

Reason for Call		Call Count	Subtotal
How to:	Enter Orders	IIIIIIIII	10
	Print Reports	I	1
	Chart IV's	IIII	4
	Chart I&O	II	2
	Chart Medications		0
Printer Problems		II	2
		Grand Total	19

Appendix C

Bar Chart

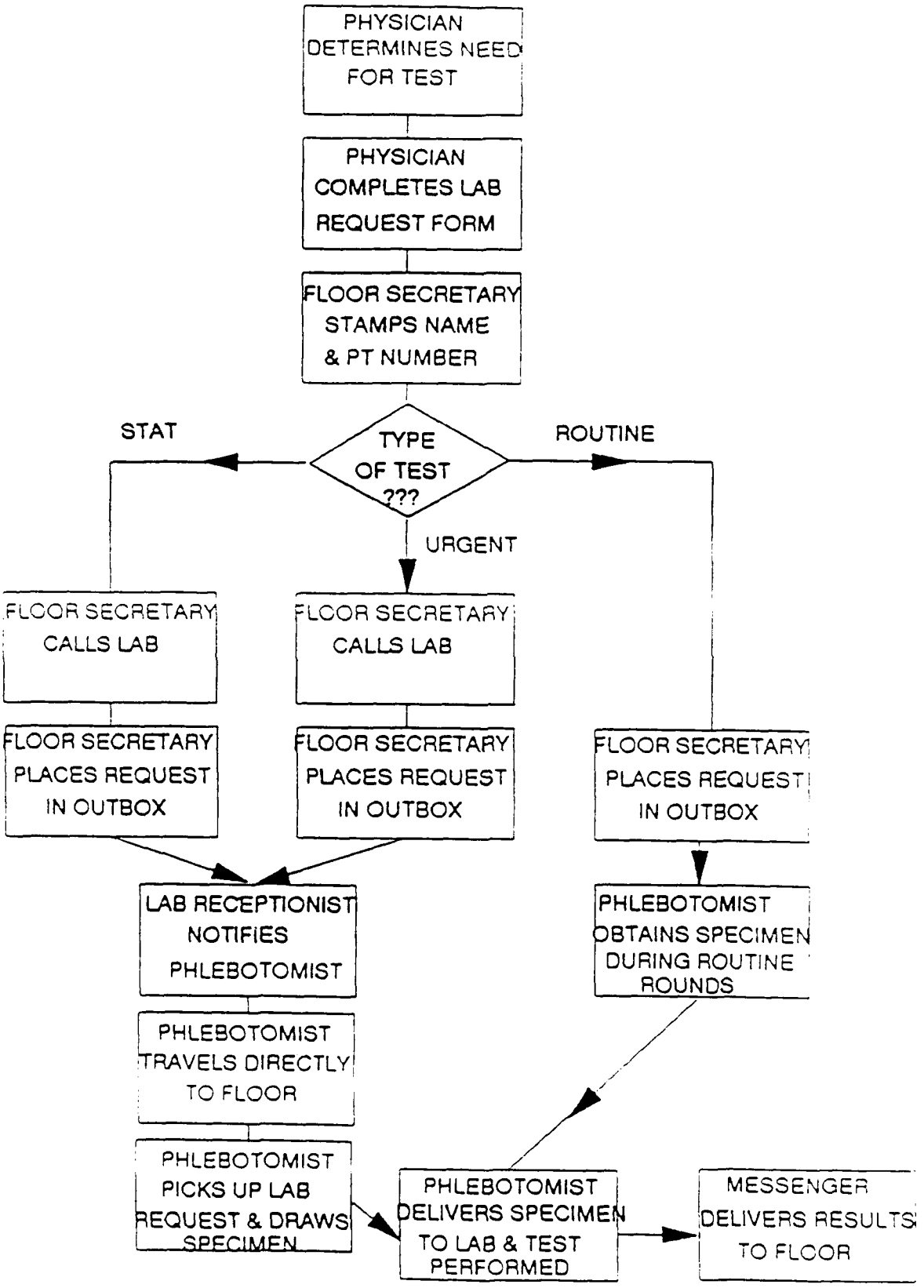
Cancelled Surgeries by Physician



Verical Bar Chart of Discrete Data

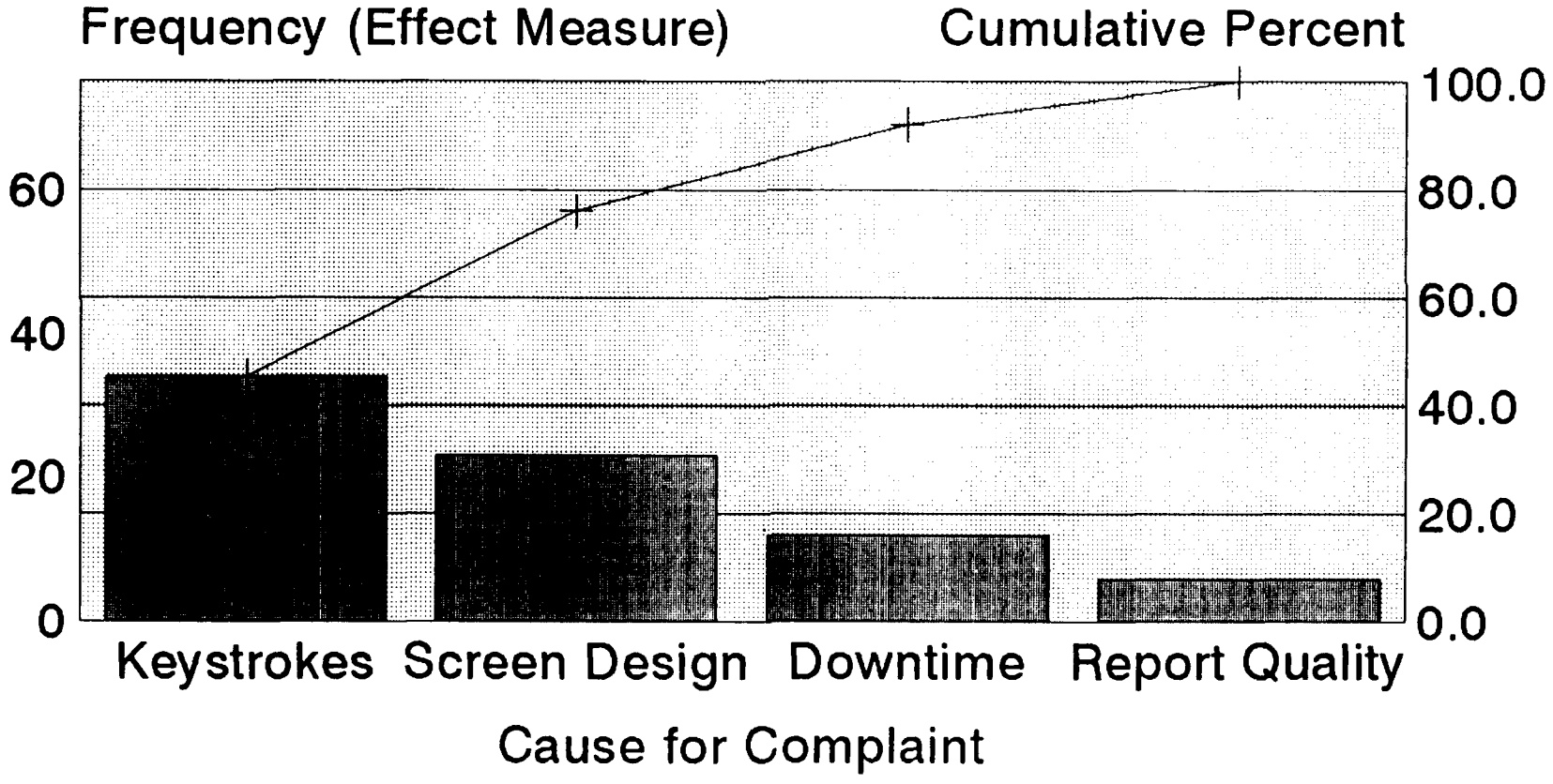
Appendix D

LAB TEST PROCESS OVERVIEW FLOWCHART



Appendix E

Pareto Chart
Reason for Complaint

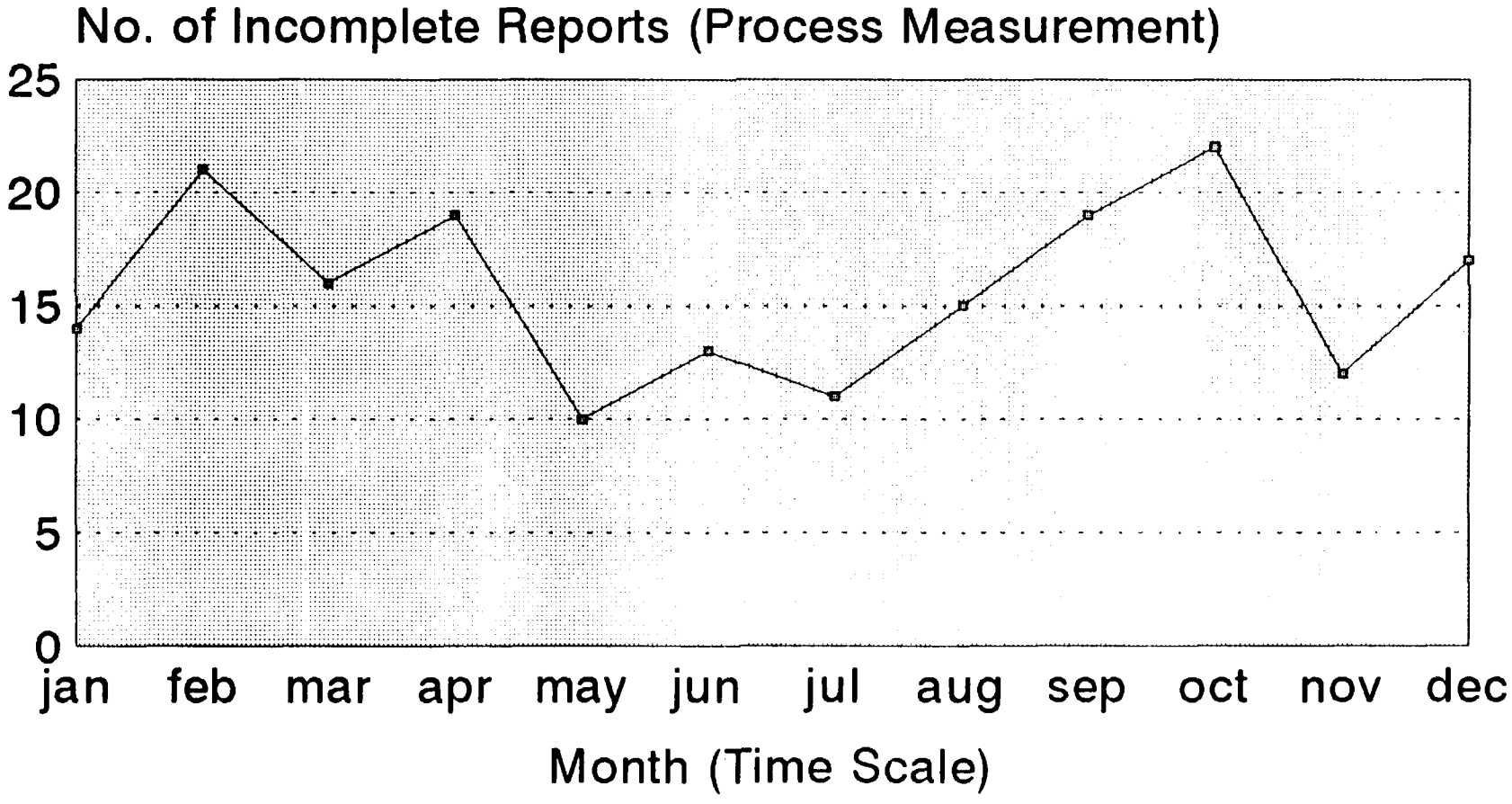


Vertical Bar Chart of Discrete Data
Used to Rank Importance of Causes
Aids in Selecting Improvement Areas

Appendix F

Run Chart

Incomplete X-Ray Reports By Month

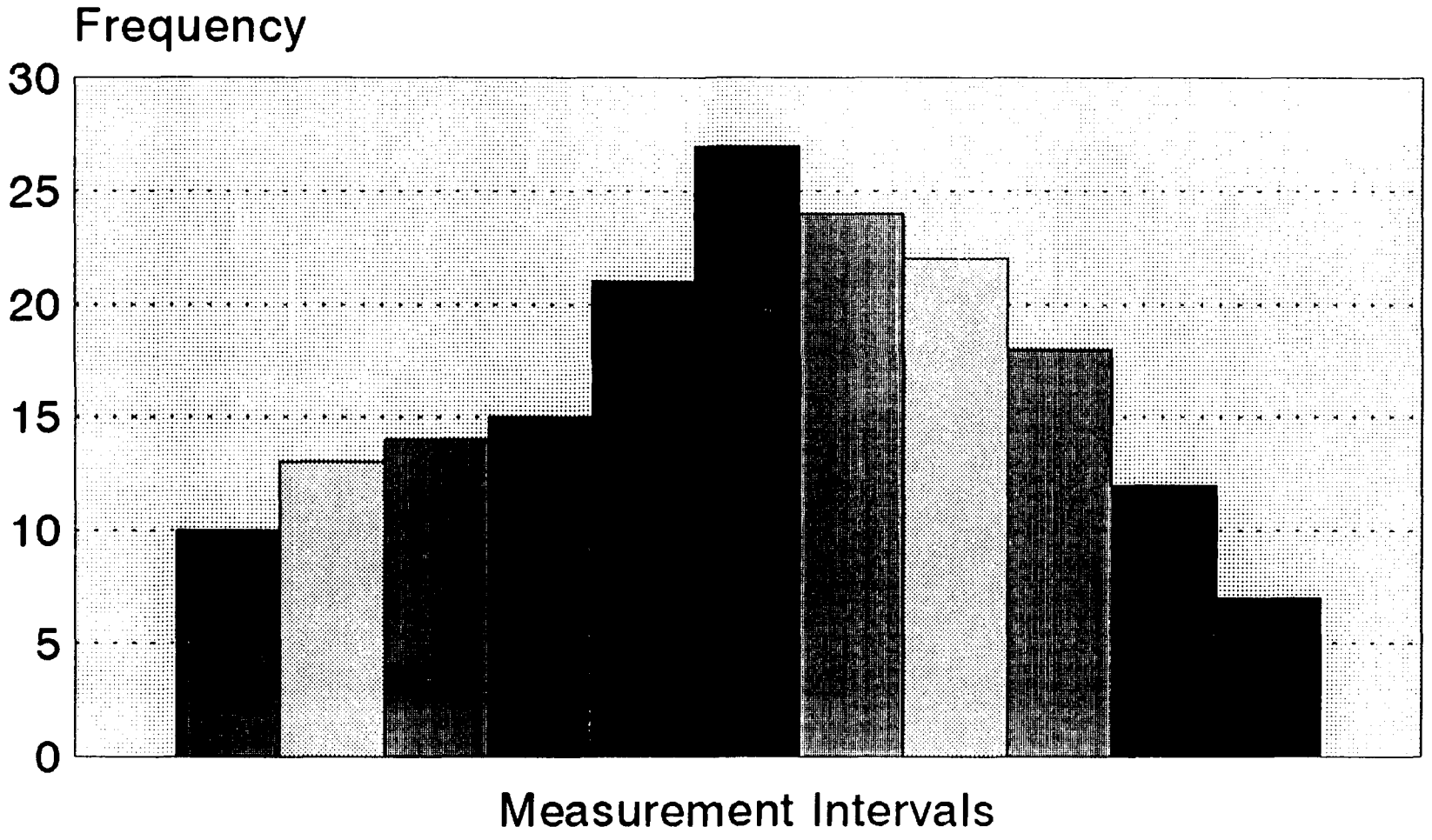


Line Graph

Displays Process Performance Over Time

Appendix G

Histogram

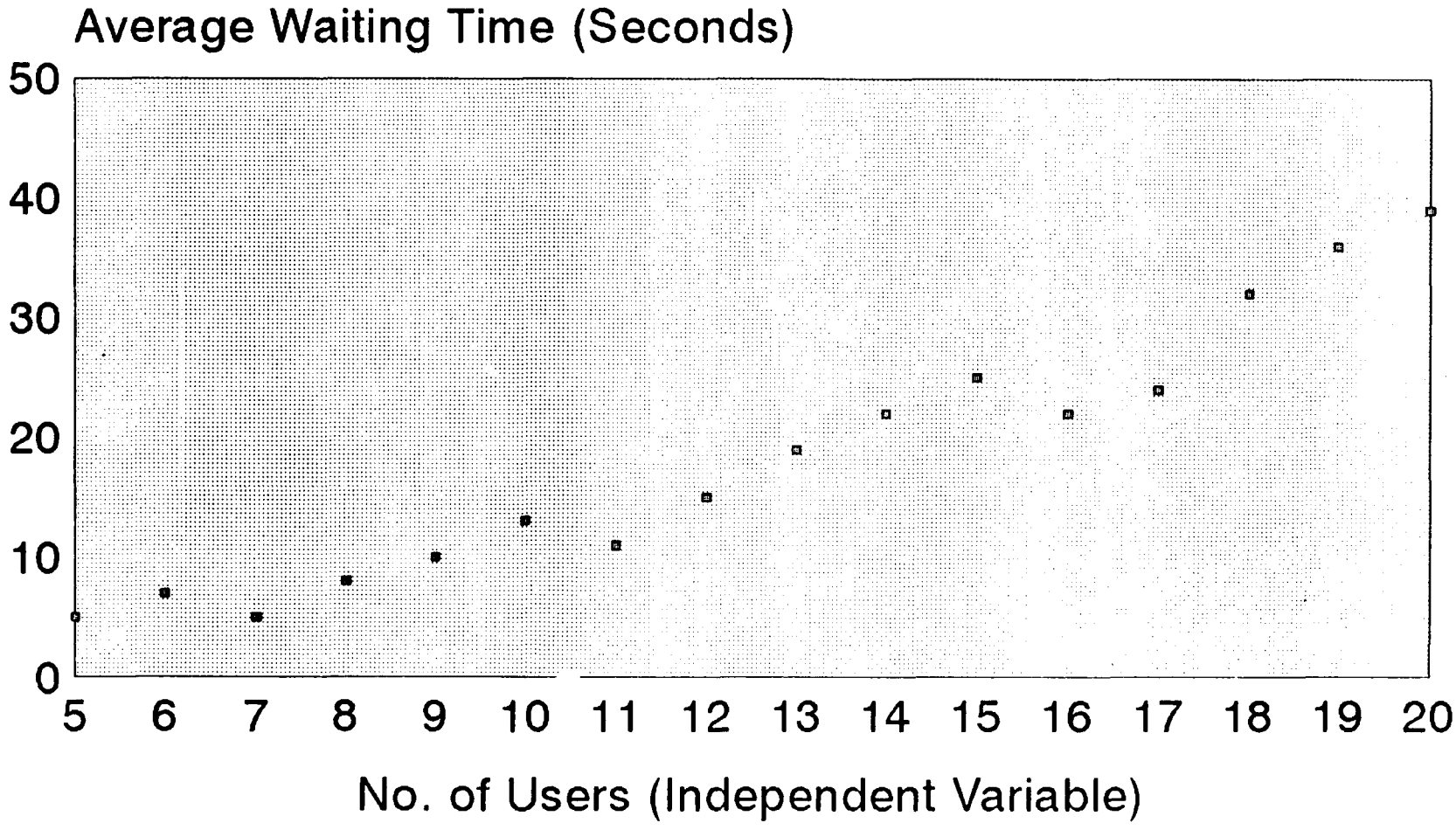


Shows Distribution of Frequency
Reveals Amount of Variation

Appendix H

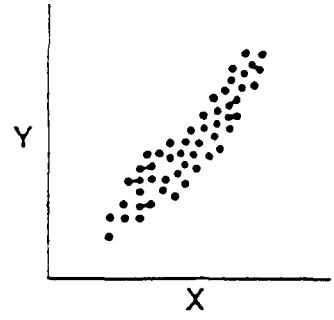
Scatter Diagram

Relationship Between No. of Users and Response Time



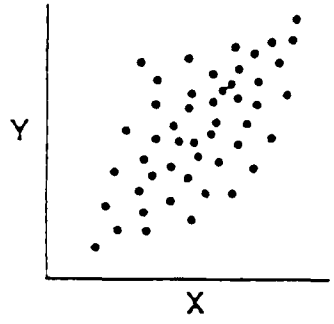
Used to Test Relationships

Interpreting Scatter Diagrams



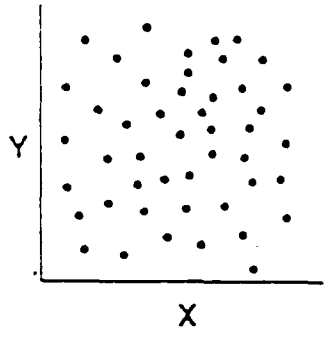
Strong Correlation

Suggests that control of one results in control of other



Weak Correlation

Suggests control of one does not necessarily result in control of other



No Correlation

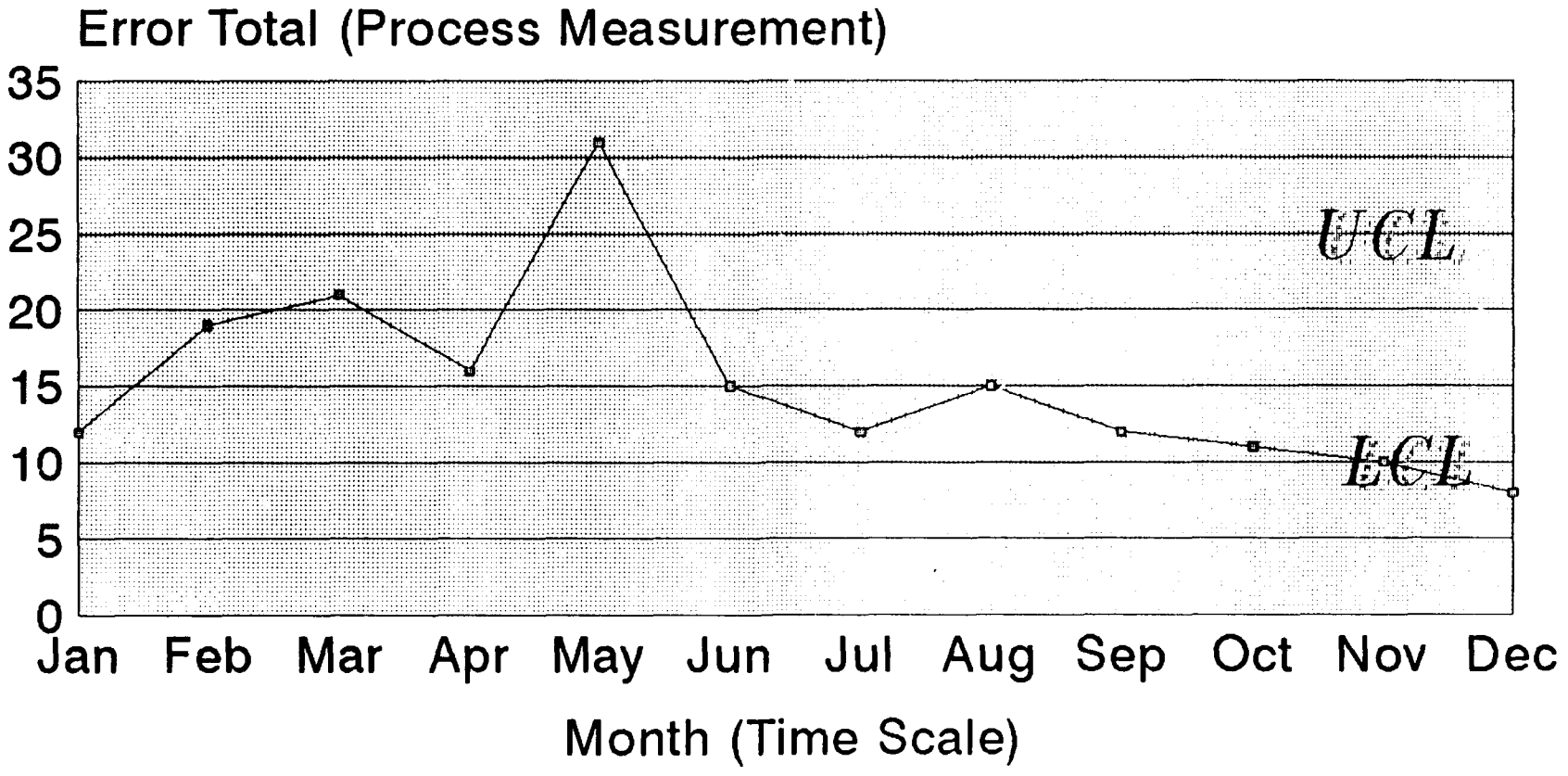
Suggests no relationship

Complex Correlation

Suggests non-linear relationship

Appendix I

Control Chart
Medication Errors by Month



Line Graph with Estimated Performance Parameters
Evaluates Stability of Process for Analysis
Assesses Effects of Improvement Actions

Crosby's Quality Management Maturity Grid

Appendix J

Measurement Categories	Stage I: Uncertainty	State II: Awakening	Stage III: Enlightenment	Stage IV: Wisdom	Stage V: Certainty
Management understanding and attitude	Fails to see quality as a management tool.	Supports quality management in theory but is unwilling to provide the necessary money or time.	Learns about quality management and becomes supportive.	Participates personally in quality activities.	Regards quality management as essential to the company's success.
Quality organization status	Quality activities are limited to the manufacturing or engineering department and are largely appraisal and sorting.	A strong quality leader has been appointed, but quality activities remain focused on appraisal and sorting and are still limited to manufacturing and engineering.	Quality department reports to top management, and its leader is active in company management.	Quality manager is an officer of the company. Prevention activities have become important.	Quality manager is on the board of directors. Prevention is the main quality activity.
Problem handling	Problems are fought as they occur and are seldom fully resolved; "fire-fighting" dominates.	Teams are established to attack major problems, but the approach remains short term.	Problems are resolved in an orderly fashion, and corrective action is a regular event.	Problems are identified early in their development.	Except in the most unusual cases, problems are prevented.
Cost of quality as percentage of sales	Reported: unknown Actual: 20%	Reported: 5% Actual: 18%	Reported: 8% Actual: 12%	Reported: 6.5% Actual: 8%	Reported: 2.5% Actual: 2.5%
Quality improvement actions	No organized activities.	Activities are motivational and short term.	Implements the 14-step program with full understanding.	Continues the 14-step program and starts Make Certain.	Quality improvement is a regular and continuing activity.
Summation of company quality posture	"We don't know why we have quality problems."	"Must we always have quality problems?"	"Because of management commitment and quality improvement programs, we are identifying and resolving our quality problems."	"We routinely prevent defects from occurring."	"We know why we don't have quality problems."

Source: Adapted from Philip B. Crosby *Quality is Free*, (New York: McGraw-Hill, 1979).

Appendix K

Juran's Categories of Quality Costs

1. Internal failure costs: Costs from product defects prior to shipment to the customer. They include:
   - Scrap
   - Rework
   - Retest
   - Downtime
   - Yield losses
   - Disposition
2. External failure costs: Costs associated with defect found after shipment to the customer. They include:
   - Complaint adjustment
   - Returned material
   - Warranty charges
   - Allowances
3. Appraisal costs: Costs associated with discovering the condition of products and raw materials. They include:
   - Incoming materials inspection
   - Inspection and test
   - Maintaining accuracy of test equipment
   - Materials and services consumed

Appendix K

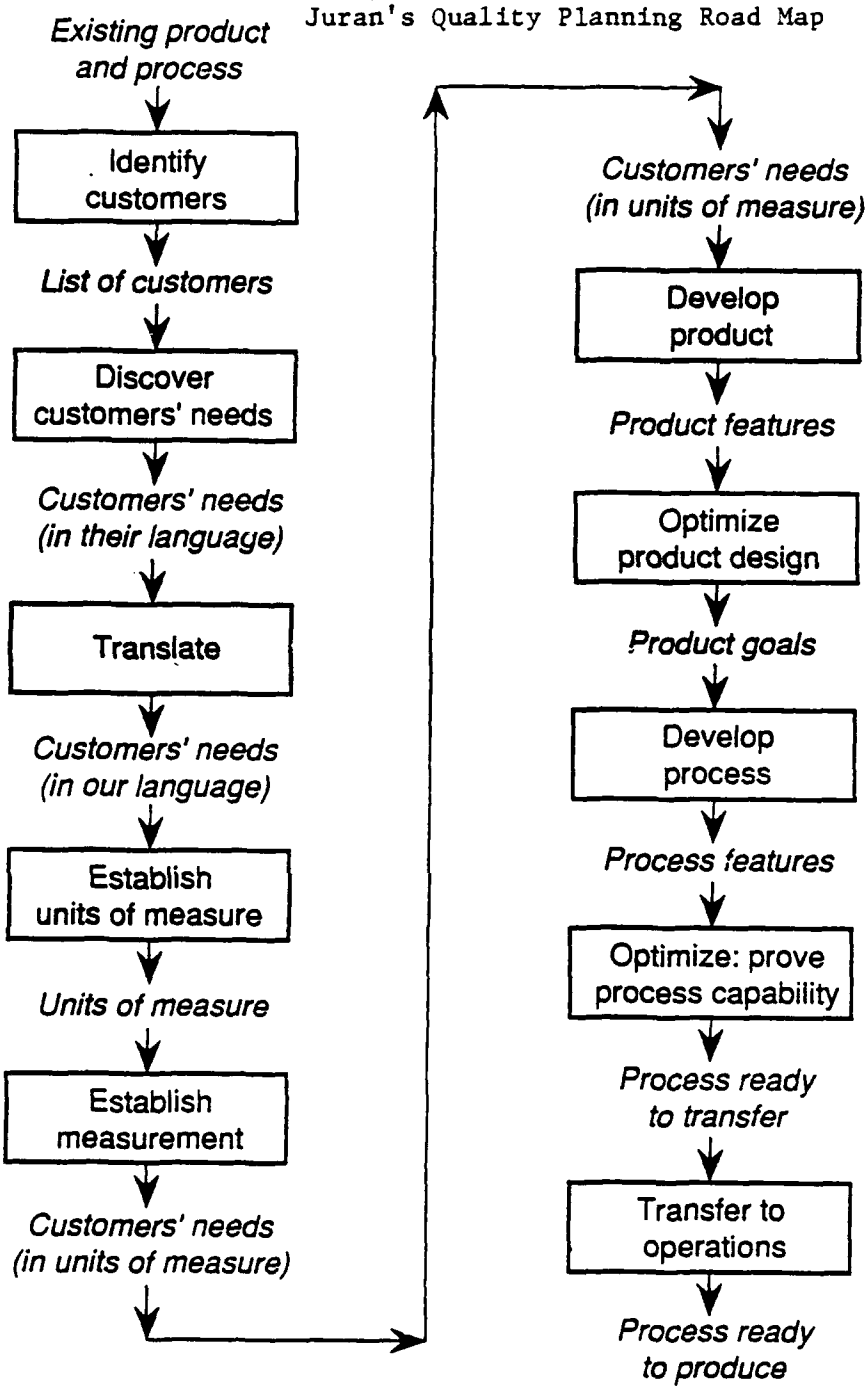
Juran's Categories of Quality Costs

- Evaluation of stocks

4. Prevention costs: Costs associated with preventing defects and limiting failure and appraisal costs. They include:

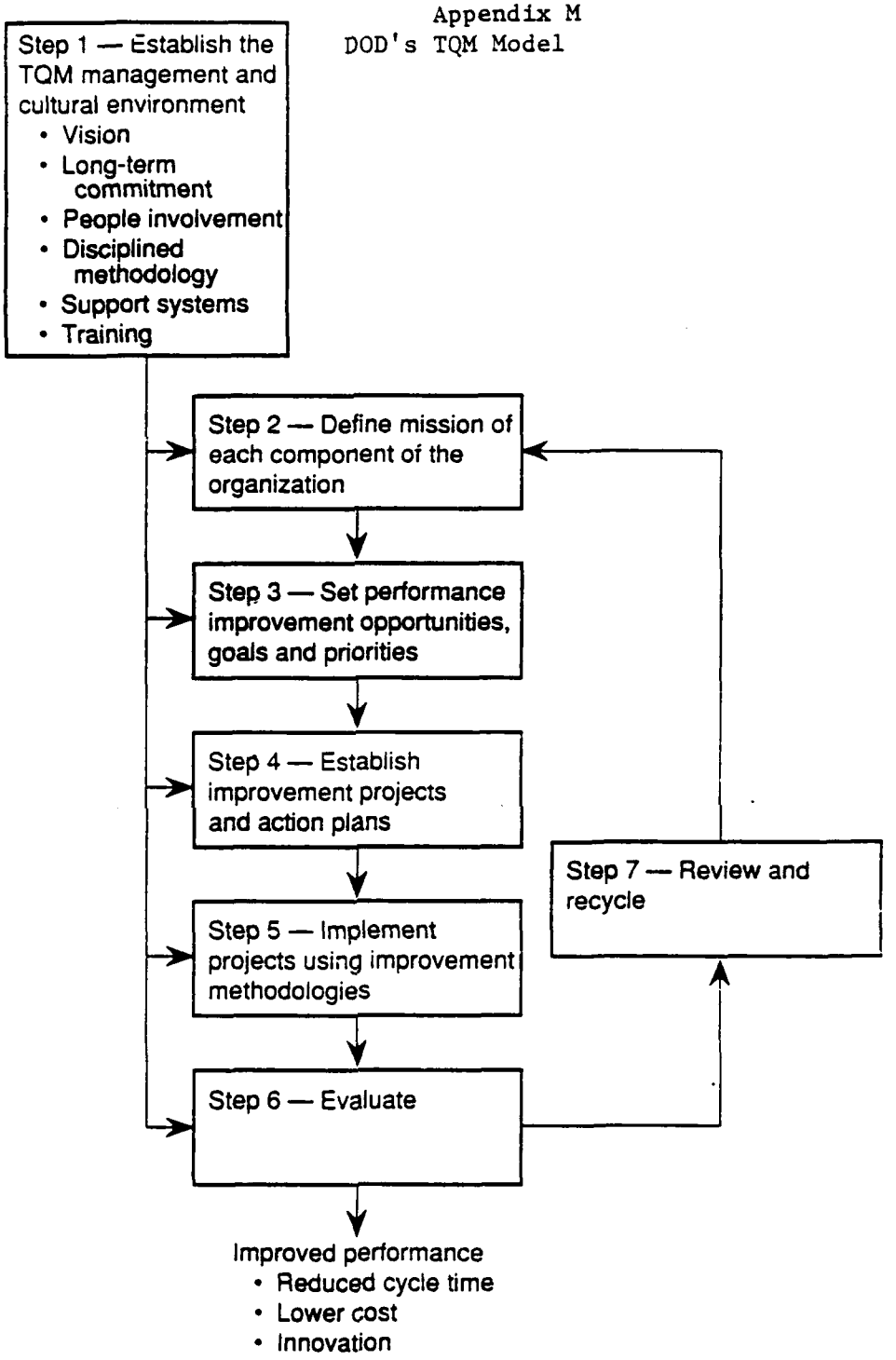
- Quality planning
- New products review
- Training
- Process control
- Quality data acquisition and analysis
- Quality reporting
- Improvement projects (Juran, 1988).

Appendix L
Juran's Quality Planning Road Map



Source: J. M. Juran, *Planning for Quality* (New York: The Free Press, 1988).

Appendix M
DOD's TQM Model



Source: Department of Defense, *Quality and Productivity Self-Assessment Guide for Defense Organizations*. (Washington, D.C.: Department of Defense, 1990).

Appendix N

DOD Total Quality Management Master Plan

Mid-Range (Three-Year) Goals:

- Harmonize DoD regulations with TQM goals.
- Eliminate attitudinal and policy barriers to TQM.
- Cultivate TQM champions in Congress
- Promote TQM programs in top defense contracting firms.

Long-Range (Seven-Year) Goals:

- Establish TQM as a way of life.
- Have all DoD personnel directly participating in continuous process improvement.
- Gain Congressional understanding and support for TQM.